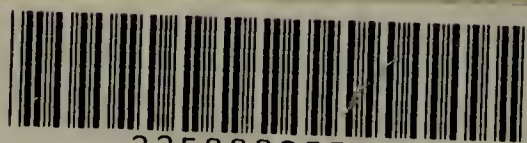




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ANALYTICAL CYCLOPÆDIA
OF
PRACTICAL MEDICINE

BY
CHARLES E. de M. SAJOUS M.D.

AND
ONE HUNDRED ASSOCIATE EDITORS

ASSISTED BY
CORRESPONDING EDITORS COLLABORATORS
AND CORRESPONDENTS

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Third Revised Edition

VOLUME V



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PREFACE.

IN presenting the fifth volume to the profession the editor cannot but express the hope that it will merit the kind appreciation bestowed upon its predecessors, not only by the patrons of the work, but also by the medical press. It has proved to be the most arduous one to prepare of the entire series, involving, as it does, almost every specialty—otology, laryngology, ophthalmology, neurology, pædiatrics, obstetrics, therapeutics, etc.—besides the sections usually classed under general medicine and surgery. The continued assistance of the members of the associate staff has greatly facilitated the labors of the central department; the indebtedness involved is gratefully acknowledged.

Death has claimed, since the publication of the fourth volume, two members of the associate staff: Dr. Norman Kerr, of London, and Dr. J. E. Graham, of Toronto. Dr. Kerr has been an associate editor since 1893, and his able articles upon inebriety, morphinism, and kindred disorders will doubtless be remembered by many of our readers, owing to the erudition displayed in them, the refined language used, and the elevated motives discernible in every line. The paper on “Morphinism” published in this volume is his last contribution to medical literature. Though written by the editor, it is elaborated in Dr. Kerr’s own words, and portrays his thoughts; while his signature bears witness to a careful revision—accomplished not long before he departed this life. The special field to which Dr. Kerr devoted his labors has lost its most brilliant exponent; the profession at large one of its most faithful and honest workers.

Dr. Graham had been a member of the staff about two years. His article upon “Cholelithiasis”—probably the finest encyclopædic review of the subject extant—typifies all his labors, and, in particular, two traits which dominated his entire career: *i.e.*, thoroughness and sincerity of purpose. His last contribution to medical literature will appear in the sixth volume of this work: the article on “Typhoid Fever.” It fully sustains his reputation as one of Canada’s most distinguished clinicians, and but accentuates the great loss which his untimely death has imposed upon the entire profession.

Two kindred subjects have been treated in a manner differing somewhat from the usual, namely: the “Disorders of Pregnancy,” by Dr. Currier, of New York, and “Abnormal Parturition,” by Drs. Grandin and Marx, of the same city. Instead of repeating text with which a physician’s shelves are usually fully supplied,—text-book matter,—these articles aim to give the newer aspects of these questions and the tendency of progressive thought.

Among the other articles presented which call for especial notice are “Pleurisy,” by Dr. Alexander McPhedran, of Toronto; “Catarrhal Pneumonia,” by Dr. Solomon Solis-Cohen, of Philadelphia; “Lobar Pneumonia,” by Dr. Thomas G. Ashton, of the same city; and “Rheumatism,” by Dr. Levison, of Copenhagen.

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SAJOUS'S ANALYTICAL CYCLOPÆDIA OF PRACTICAL MEDICINE.

O

ŒSOPHAGUS, DISEASES OF.

Malformations.—*Congenital occlusion*, due to the fact that during embryological development the invagination forming the mouth fails to open into the posterior end of the primitive intestine; *diverticula*, of similar origin, and *fistulæ* due to incomplete closure of the branchial clefts represent the main malformations met with in this region. *Congenital narrowing* due to abnormal thickness of the wall or to the presence of membrane and *congenital dilatation* are also, though very rarely, witnessed.

Acquired Diverticula (Pharyngoceles).

SYMPTOMS.—A diverticulum may occur as the result of inflammation or injury; the œsophageal wall is weakened, a portion of it bulges out, forming a circumscribed sac, or hernia, through the muscular coat. While small, a pouch thus formed is hardly noticed, but, as small particles of food find their way into it, it is gradually enlarged, projecting downward. It may become several inches deep, is usually elongated, and appears externally as a pear-shaped growth between the larynx and the sterno-mastoid muscle. It may, by its pressure, displace the œsophagus and

the larynx, causing violent coughing through pressure upon the superior laryngeal and dyspnœa. Dysphagia, fœtor of the breath, regurgitation of ill-smelling masses of sodden food, and local pain are experienced in severe cases. Death from inanition has resulted.

DIAGNOSIS.—A diverticulum may easily be recognized by palpation, especially when the patient is lying on his side, the tremor being upward. When it contains air, pressure upon it causes this to pass out and its size is reduced; when it contains food, pressure either causes marked lateral displacement of the œsophagus or the food is forced up into the œsophagus and mouth. It is often enlarged after meals. The sound may be used; it should be bent so as to enable it to enter the cavity, and be handled with great gentleness.

ETIOLOGY.—Inflammation and injury to the muscular coat are the predominating factors. It is usually observed in men, and at the spot where the pharynx ends to become the œsophagus. The congenital forms are usually situated near the inferior constrictor.

TREATMENT.—Operative procedures are alone of value. The tumor should be reached and excised and the margins se-

cured with catgut sutures. This measure, introduced by Wheeler, is usually successful.

Traction Diverticula.

This is a form of diverticulum which presents itself near the bifurcation of the trachea, in the anterior wall of the œsophageal canal. It is generally associated with inflammation of the lymph-glands in this locality. Local inflammation followed by ulceration gives rise to cicatrices which by their contraction draw on the œsophagus: *i.e.*, exercise traction upon it, forming a cavity opening into the œsophageal canal by a funnel-shaped orifice.

SYMPTOMS.—Mechanical irritation is occasionally produced by the retention of food, and ulceration may follow, attended by its usual complication—perforation. A fistula between the œsophagus and the bronchial tract may be followed sooner or later by pneumonia.

The pleura and pericardium may also be reached. In the majority of cases the symptoms are slight; it is only on account of the possible mortal complications that traction diverticula demand attention.

TREATMENT.—Surgical removal alone affords protection against possible complications.

Foreign Bodies in the Œsophagus.

Foreign bodies frequently become impacted in the œsophagus, fish-bones, pieces of meat, pins, tacks, artificial teeth, coins, and buttons representing the class of articles found in the majority of cases.

Symptoms.—These vary according to the shape, size, and location of the impacted agent. A large mass, such as a piece of meat, may become engaged behind the larynx and hold the tip of the epiglottis down, completely closing the laryngeal cavity. Here, intense dyspnœa

soon comes on and death from asphyxia may promptly follow. Or a part of a bolus may invade the larynx and cause violent spasm; asphyxia again becomes possible from two causes: spasm and reduction or total closure of the respiratory area. Small bodies may produce the same symptoms, but, as is the case with large masses,—meat, bread, etc.,—they seldom give rise to dangerous symptoms, unless the larynx is involved by pressure, puncture, or the epiglottis is held down in some way.

Sharp or irregular bodies,—such as chicken-bones, tacks, etc.,—when impacted only in the œsophagus,—usually at its upper portion and immediately behind the cricoid cartilage,—only cause marked discomfort and severe pain, especially marked during deglutition; but they are attended with little or no immediate danger. The pain may radiate in various directions. Hæmorrhage or rather slight bleeding is occasionally produced. After some time, varying with the size and shape of the body, the acute suffering ceases and pain is only experienced during deglutition.

If the impacted body is low down, which is frequently the case when it is small, it is only at this time that its true location can sometimes be established, the sensations before this being misleading. But the pain even at this time may only indicate the location of a lesion produced by a rough or sharp body during its passage to the stomach.

Left *in situ*, foreign bodies always tend to create local lesions, unless, as sometimes happens, spontaneous expulsion occurs after the primary local irritation and the general excitement of the patient has ceased. Local inflammation is caused, the tissues become softened, abscesses arise which may burrow in various directions, sometimes reaching

into the pleura, the pericardium, the mediastinum, or the larger vessels, including even the aorta. The foreign body itself may follow either of the channels formed and cause death by reaching any of the organs of the thoracic cavity. Needles particularly are prone to migrate in various directions and sometimes appear at a spot quite remote from the gullet and totally disconnected with it as to continuity of tissue.

Small bodies that pass into the stomach seldom give rise to trouble, being usually passed *per anum* a day or two later. In one of my cases, a child three years of age, the foreign body was a screw one and a half inches in length. It was passed on the third day without having caused the least discomfort.

Treatment.—It is important to bear in mind, in all such cases, that a scratch or erosion of the mucous membrane produced by a passing angular bone—a fish-bone, a pin, etc.—gives rise to symptoms simulating the actual presence of such a body. It is quite difficult at times to convince the patient that there is nothing in his gullet.

Cases in which dyspnœa is a symptom demand immediate assistance. I have found this to be afforded most promptly by passing the index and middle fingers of the right hand into the mouth (which makes it possible to reach farther down than when one finger is introduced) and inserting the *middle* finger into the *left* pyriform sinus. The middle finger is then passed rapidly behind the larynx. The portion of the foreign body in the œsophagus is thus reached and generally swept aside, drawing out of the larynx the part engaged in it or holding down the epiglottis. If it is impacted, the index finger is brought into use, and by closing upon the middle finger a grasp is obtained upon the obstructing substance.

In some cases the larynx is deep-seated and is reached with difficulty, but the mouth of the patient can stand considerable stretching, if need be, considering the imminent danger of death. This procedure is, of course, only applicable in cases in which the foreign body is situated in the upper part of the œsophagus and close to the larynx, but, as already stated, these alone expose the patient to immediate death.

When dyspnœa is not present, the laryngeal mirror often greatly assists in the examination of the cavities involved, and it is rare, with a good light, that a body situated not far below the larynx cannot be detected. It also assists in properly introducing and directing any instrument or forceps that may be introduced. Round and smooth articles may be pushed down with a probang when they cannot be extracted with forceps. The horse-hair probang, Graefe's coin-catcher, etc., are useful, but they must be used with gentleness. Emetics should never be used, since the contractions of the œsophageal muscles tend to force the body through the walls of the organ.

When fish-bones, meat, or meat-bones are impacted, vinegar hastens their disintegration and small quantities may be sipped. Foreign bodies that have passed into the stomach are said to be assisted in their migration through the intestinal tract by the use of mashed potatoes as food.

Irregular large bodies, tooth-plates, large bones, etc., when inaccessibly located, demand œsophagotomy (*vide supra*) or gastrotomy (see STOMACH, SURGERY OF).

Injuries of the Œsophagus.

The œsophagus is often involved in injuries inflicted with suicidal intent, the ingestion of corrosive fluids and attempts at throat-cutting being the chief

casualties of this kind met with in practice. Many accidents occur also through the accidental swallowing of acids or strong alkalies,—concentrated lye, for instance,—or a household disinfectant, such as carbolic acid, or, again, boiling tea or coffee from the spout of a vessel. A corrosive substance taken by a suicide is usually taken hastily and thrown, as it were, far back into the mouth. Spasm of the larynx usually ensues and collapse follows. The same effect is generally, however, produced in accidental cases, and the lips, the gums, or even the front part of the tongue do not always indicate the severity of the lesions produced. If death does not immediately occur from laryngeal spasm,—*i.e.*, asphyxia and shock,—severe pain is experienced and acute œsophagitis (see below) ensues. Wounds of this region due to accidents or military weapons are extremely rare, however, but one injury of the œsophagus, for instance, having been recorded during the Rebellion. The protected position of the œsophagus anteriorly and posteriorly seems to account for this, the sternum and spinal column acting as shields.

Œsophagitis.

Symptoms.—In cases arising from injury of the œsophageal tissues pain is marked, especially during deglutition, unless the traumatism be of such a nature as to completely destroy the tissues and their nervous supply, as sometimes happens when caustic acids are swallowed. Under these circumstances slight pain in the periphery of the disorganized mass is the general result. The pain usually experienced is continuous and dull, and usually follows the long axis of the sternum, extending to the back and neck. Motions of the head or shoulders sometimes aggravate it. At times it is burning, especially if the le-

sion is not deep-seated and when regurgitation of the acid gastric contents occurs. Spasm is frequent in such cases. A sensation suggesting the presence of a foreign body is complained of.

After a lapse of time, varying with the gravity of the injury, hæmatemesis may occur, owing to the contraction of the muscular supply around the ulcerated areas that are undergoing the process of repair; but this is generally of short duration. Large quantities of mucus and muco-pus are often voided.

The sequelæ of these cases are usually serious. Even after slight injuries, sometimes, cicatricial stenosis occurs that leads to œsophageal stricture.

The presence of blood in the food and localized pain suggest that a foreign body may be present when no other clear indication is furnished by the history. This form often becomes phlegmonous and is usually attended by a febrile reaction. Pseudomembrane may also be vomited: indicative of the form of stenosis present. Thrush, it must be remembered, may be attended by no other symptom than impediment to the passage of food.

In some cases the local inflammatory symptoms—difficult deglutition, the muco-purulent discharge, etc.—continue for some time. Such cases are termed *chronic* œsophagitis by some authors.

Diagnosis.—In traumatic cases the history and the symptoms render the diagnosis easy. The location of the pain usually points to the seat of the lesion; this may be verified by the passage of the œsophageal sound: a dangerous procedure in severe injuries. In acute œsophagitis occurring in the course of febrile diseases a condition with which it may be confounded is the irritation following repeated vomiting of acid substances. The discomfort resulting from

this, however, is of short duration, while the symptoms of true œsophagitis are continuous and more marked.

Etiology.—Almost all cases of acute œsophagitis are due to mechanical and chemical irritation or destruction by caustic acids, hot liquids, and foreign bodies. Cases due to the ingestion of acids are often met in connection with attempts at suicide, while the two latter exciting factors usually come into play accidentally. Carbolic acid is most frequently used by suicides, while the accidental agents are boiling liquids, concentrated lye, and spicules of bone.

Acute inflammation also occurs as a complication of infectious fevers, typhoid fever, typhus, pneumonia, pyæmia, small-pox, etc., while pseudomembranous œsophagitis may be caused by extension of a disease, such as diphtheria, in which a false membrane is present. Various pharyngeal disorders complicated with abscess may also extend to and involve the œsophagus in the inflammatory process. Malignant neoplasms, especially carcinoma, of the œsophagus may be accompanied by acute œsophagitis. Among the rare causes are: the prolonged administration of tartar emetic (Laennec), vertebral abscess, laryngeal perichondritis, and hysteria.

It is occasionally met with in sucklings without explainable cause.

Pathology.—Desquamation of the epithelium and erosions are present when comparatively mild caustics or strong solutions of them have been swallowed, but, when such agents as pure carbolic acid, concentrated lye, etc., have been taken, the entire mucous lining may be deprived of its epithelium. It then becomes greatly swelled, and purulent infiltration usually follows the primary serous infiltration. The mucous layer may thus be detached from the under-

lying tissues. Foreign bodies may also cause deep-seated lesions and be surrounded by a cushion-like mass, causing temporary œsophageal stenosis. Gangrene occasionally follows, necrotic masses being ejected, generally with vomitus. The local disorder occurring as complication of fevers, etc., is usually less marked, though diffuse purulent inflammation occasionally occurs.

Treatment.—Beyond the relief of pain by means of hypodermic injections of morphine there is but little to do in this condition. In cases due to the ingestion of chemical agents the antidotes indicated under each special head are, of course, to be used if the case is seen sufficiently early, but, for the lesions themselves, the administration of demulcents,—the white of egg, for instance,—sips of ice-water, etc., represent about the only means at our disposal. When deglutition causes severe pain, or there is reason to believe that there is much tissue-destruction, it is best to feed the patient entirely by the rectum.

After injuries of the œsophagus cicatricial contraction is a normal sequel. This should be prevented by the use of bougies. The technique of this procedure is given below.

Stricture of the Œsophagus.

Symptoms.—Narrowing of the œsophageal lumen—whether due to cicatricial contraction or to tumors, intramural or extramural; aneurisms, etc.—is attended by gradually-increasing difficulty in swallowing, referable, in the majority of instances, to a particular spot under the sternum. At first solid food is passed with increasing difficulty, and the patient finds it necessary to masticate with great care or swallow smaller boluses. A feeling of pressure is usually experienced as the food gravitates downward, which in some cases enables the patient

to gauge the steadily-decreasing rapidity with which the food reaches the stomach. Later on these masses require the assistance of fluids, and finally only the latter can pass with ease.

The first effort at swallowing at a meal is generally the most arduous, the subsequent boluses passing with comparative ease. Various motions of the head are resorted to by the patient in the vain hope to assist the act of deglutition. As the difficulty increases, the patient gradually becomes weakened and emaciated through deficient nutrition.

In stricture due to cancer the contraction is rapid and death from pneumonia is not uncommon. When this does not occur, the tissues around the œsophagus are gradually implicated by extension, and death occurs from marasmus due to general toxæmia, this being greatly encouraged by starvation. The sense of hunger, however, is not acute. The vomited materials are often tinged with blood, and the general facies of the patient soon serve to indicate the presence of a malignant neoplasm. Glandular infiltration occurs late in the disease.

Diagnosis.—Certain destructive points serve to locate the seat of the stricture. Regurgitation of the food usually occurs immediately when the stricture is situated near the upper orifice. That the rejected food has not reached the stomach can easily be recognized by the absence of the characteristic odor. The material ejected is also alkaline instead of strongly acid: a valuable diagnostic feature. When the narrowing is low down the œsophagus is dilated above, and the food is accumulated in the pouch-like cavity formed. Regurgitation, instead of occurring promptly after the ingestion of food, only takes place several hours later, and is mixed with considerable mucus. Here, again, the

material ejected is not acid, having failed to reach the stomach. The accumulated food sometimes causes dyspnoea by pressing upon the trachea.

Auscultation of the œsophagus may sometimes be employed with advantage; provided, however, the examination be conducted in a very quiet room. The stethoscope is usually employed, but direct application of the ear along the left of the spine—while the patient brings his shoulders as close together anteriorly as possible—is far more satisfactory. A peculiar irregular wave-like bruit is heard when liquid is swallowed, followed by a second splashing sound as the fluid reaches the stomach. When a stricture is present the wave-bruit and the splashing sound are varied in proportion, the latter being absent in some cases of advanced constriction or replaced by repeated splashes following one another more or less in rapid succession.

Far more precise, however, is the information acquired by means of the œsophageal sound—especially the graded, olive-tipped, flexible bougie. The patient being placed upon an ordinary chair (avoiding one with a high back), the physician stands behind him. He should use his left hand as guide for the instrument, by placing it on the patient's face so as to bring the index and middle fingers over and parallel with the patient's mouth. The patient's head being thrown back, the bougie (warmed and lubricated with glycerin) should first be passed between the fingers and then introduced into the mouth perpendicularly—much as a sword-swallower introduces the weapon. The olive-tip, however, should *not* penetrate the œsophageal canal by passing *over* the larynx, but into the pyriform sinus on either side of the larynx. Each sinus affords a funnel-like aperture which

allows the bougie to glide easily into the œsophagus, without encountering the bodies of the cervical vertebræ or the cricoid cartilage. The instrument should not be forced down, but allowed to drop into the cavity by reason of its own weight.

[The present method of introducing the instrument over the middle portion of the pharyngeal wall, and therefore over the centre of the epiglottis and the posterior surface of the larynx, is defective, and accounts for the resistance usually encountered while introducing the instrument.

I have found the procedure herein described far more effective, and, when gentleness is used, far safer than that recommended in text-books. CHARLES E. DE M. SAJOURS.]

Frequently a spasm of the muscles causes the instrument to suddenly be arrested; but after a few seconds this ceases and arrest only occurs at the seat of the stricture. When this happens the instrument should be allowed to remain *in situ*; after a few moments it often suddenly drops lower down. In some cases it is advisable to first anæsthetize the pharynx and that portion of the œsophagus within reach with a 4-per-cent. solution of cocaine. When permanent arrest occurs below the larynx, the spot (gauged by length of bougie introduced) should be estimated and a slightly smaller bougie then tried. This is repeated until one is obtained that penetrates the opening—of which it affords an approximate diameter for future comparison. In some cases only narrow catgut will pass. Gum-elastic stomach-tubes may be used, but they do not afford the exact information obtained from the olive bougie. It should not be used, however, when an aneurism is known to cause the stricture.

Great care and gentleness should invariably prevail. The procedure is not

devoid of danger even in the hands of an expert, softening of the tissues, especially in the low strictures, readily yielding to the pressure of the instrument.

[I have witnessed a case in which a pint of milk was thus introduced into the mediastinum, as shown by the autopsy. CHARLES E. DE M. SAJOURS.]

The presence of stricture having been determined, the history almost invariably points to its original cause. The case should be *completely* examined, however; a history of syphilis with tertiary pharyngeal symptoms may be obtained, for instance, and the stricture be ascribed to cicatricial stenosis, while in reality the true cause may be an aneurism. All the etiological factors should be borne in mind and the prevailing one determined by elimination.

In stricture due to cancer the stenosis is usually situated where the left bronchus forms a ridge in the œsophageal mucous membrane, but no portion of the canal can be said to be exempt. The vomited matter is often tinged with blood and the cancerous facies soon serves to establish the diagnosis. Emaciation is generally very rapid. The possibility that a stricture may be cancerous imposes additional care in the use of the bougie, the friability of the cancerous tissues being such as to easily yield to even slight pressure. A stricture occurring after the fortieth year in a man whose history does not present strong evidence of syphilis, tuberculosis, or local injury is usually cancerous.

Etiology.—Stricture of the œsophagus may be congenital, but it occurs, in the majority of cases, as a result of lesions produced either by the ingestion of corrosive liquids or by ulceration occurring as complication of infectious diseases, particularly typhoid fever. Syphilitic ulceration of the œsophagus,

though, is usually followed by stricture varying in degree with the location of the ulceration and the area involved. Impacted foreign bodies, masses of thrush-fungus, local tuberculosis, injuries—*i.e.*, all conditions capable of causing severe acute œsophagitis—may act as primary causes. A greatly-enlarged thyroid, an aneurism, an intramural abscess, enlarged lymphatic glands, growths of the mediastinum, etc., may also, by pressure upon the œsophagus, reduce its lumen. Cancer of the œsophagus is not an uncommon cause.

A comparatively frequent cause of stricture is squamous epithelioma: almost the only form of neoplasm encountered in the œsophagus. It is usually met with in men, and after the fortieth year.

Pathology.—The pathology of stricture varies with the cause, but in practically all cases due to local lesions, excepting cancer, the prevailing feature is the presence of cicatricial tissue. In cases originating from the ingestion of corrosive fluids the stricture is usually high, spasm of the œsophagus generally preventing gravitation of the liquid to the lower part of the organ. In all others, even syphilis, the chances are that the stricture—there is generally but one—will not be far from the lower third, or lower down. The extent of tissue involved varies frequently, and occasionally the whole lumen of the œsophagus is more or less involved and distorted. In the majority of cases in which the stricture is low, there is sacculation or dilatation of the portion above the stenosis.

Prognosis.—In cases of cicatricial stenosis the prognosis is quite favorable under appropriate treatment. Without treatment the contraction usually reduces the lumen sufficiently to prevent

alimentation, and the patient dies of slow starvation. Cases due to cancer are naturally hopeless, while the prognosis of cases resulting from the pressure of surrounding growths, aneurisms, etc., depends upon the degree of curability of the latter.

Treatment.—The aim of the treatment is obviously to restore the lumen of the œsophagus to its normal dimensions as nearly as possible, but in cancerous stricture this is hardly indicated, the neoplasm itself involving complications that bring on a fatal issue. For this reason a distinct line should be drawn between cases of stricture due to cicatricial lesions—*i.e.*, injuries, syphilis, tuberculosis, etc.—and those due to a malignant neoplasm. In all of the former dilatation with the bougie may be said to be required as soon as a stricture has been recognized; in cancerous stricture the procedure should not be resorted to. It but inflicts severe suffering upon the patient and involves additional risk.

Cicatricial stricture may be expected in all serious injuries of the œsophagus. Hence, after an accident or a local disorder known to be followed by cicatrization, stenosis should be prevented by dilatation with bougies employed in the manner indicated under **DIAGNOSIS**. Dilatation should be begun as soon as there is a reasonable evidence that an ulcerative process no longer exists, and be repeated daily, beginning with a medium-sized tube and ending with one representing the normal diameter of the œsophagus. The surgeon should not wait until symptoms of stenosis appear, since this often occurs only after considerable narrowing of the lumen. In some cases stenosis returns as soon as the bougies are not introduced, and the patient is required to personally use the

instrument during the rest of his life. Whether begun early in the history of the case or late, the procedure is generally effective, but in old cases the tissues yield with difficulty and sometimes greatly tax the patience of surgeon and patient. It is sometimes necessary to begin with catgut, which can be left *in situ* until the following visit, when the smallest bougie can often be introduced. The catgut does not prevent the passage of liquids and the patient can be fed as usual. As large a bougie as the stricture will admit is then introduced every day, and a larger one substituted every few days until the largest number is easily passed and retained several hours daily.

Permanent tubage of the œsophagus, introduced by Symonds, of London, has won much favor. The tubes are "from four to six inches in length and are made of gum elastic upon a silk web, the outside and inside being as smooth as possible. The upper end is funnel-shaped so as to rest upon the face of the stricture, and slightly flattened on one side (that it may not press unduly against the back of the cricoid) and the margin is perforated in two places for the attachment of a silk thread. The other end is hollow, with a lateral opening. The tube can be introduced upon a bougie, but it is more easily managed with a proper whalebone guide set in a suitable handle. The exact site of the stricture is ascertained first and marked upon the guide; the greatest gentleness must be used, and as soon as the point enters the narrowed part the tube is slowly pushed onward until the resistance to the funnel is felt; the guide is then withdrawn and the silk thread attached to the tube tied around the ear or fastened with strapping. A tube of this kind can be left for two or three months without being changed, the pa-

tient swallowing liquid food through it. As a rule, however, it is necessary to remove the first after three or four days, as the stricture always dilates to some extent, and sometimes this must be repeated. Even if it should slip through, it will pass *per anum* or remain lodged in the stomach without inconvenience" (Mansell-Moullin). This method is said to be devoid of risk to life, and a sufficient amount of food can readily be ingested.

When these short tubes cannot be used or when they cause cough during deglutition Krishaber's or Morell Mackenzie's long tubes, or, better still, a long, catheter-like rubber tube can be employed and left *in situ* several days at a time.

Operative procedures are sometimes resorted to.

Internal œsophagotomy, an operation based on that of urethrotomy, wherein the cicatricial bands are cut, has not given the satisfactory results claimed for it. It is only warranted in cases of annular stricture. Œsophagostomy is preferred when the stricture is high enough to be reached through the side of the neck, the incision being made between the pharynx and larynx on the left side, toward which the œsophagus leans in this region. The trachea then finds itself on one side of the incision and the carotid sheath on the other. The location of the stenosis having been determined, it is as nearly as possible made to correspond with the upper part of the incision, which should also include the œsophagus. Sometimes the omo-hyoid must also be incised. A rubber tube is then introduced, and the permanent fistula formed serves for its easy introduction and withdrawal. The patient can thus be easily fed, the tube passing under the stenosis. The operation is not an easy one, owing to the proximity of

large vessels and other easily-wounded structures.

In cancerous stricture it is inadvisable to pass bougies, as already stated; but a soft-rubber catheter with large fenestra, passed every other day or oftener, often serves to keep the passage open. It may also be left *in situ* and serve for the introduction of liquid food. Rectal feeding should be resorted to when œsophageal alimentation becomes impossible, but when rectal feeding in turn becomes insufficient—which often happens when continued several weeks—gastrotomy should be resorted to. Through the opening thus obtained to the interior of the stomach it is possible to very satisfactorily supply the patient with all the food he requires. The improvement is usually rapid, and comparative comfort is insured until the toxic effects of the neoplasm bring on death. (See STOMACH, SURGERY OF, for the details of the operation.)

Dilatation of the Œsophagus.

Etiology and Symptoms.—Dilatation of the œsophagus may be congenital, as stated, but in the majority of cases it occurs as the result of stenosis of the lower end of the tube, which, by its resistance to the passage of food, causes its accumulation in the œsophageal canal. To compensate for this the walls become greatly hypertrophied. This condition is followed, as elsewhere, by softening, which in turn causes the canal to yield to the pressure of its contents, and to become greatly enlarged.

Generally, small quantities of food are passed into the stomach at a time, and the pouch-like cavity becomes gradually emptied between meals. But regurgitation occurs when this process is too slowly performed, and the frequent invasion of the larynx by the food thus

brought up causes strangling and cough, besides the dysphagia experienced.

The bougie may be used to advantage, the large dimensions of the cavity and the narrow orifice met below being characteristic. Side-pouches may cause the sound to be arrested if it is not introduced perpendicularly or if distension of the canal is present.

Treatment.—Contraction of the dilated organ may sometimes be facilitated by introducing a long rubber tube or bougie and using it as the only avenue for the introduction of food into the stomach. Symond's tubes are too short for this purpose, and an arrangement based on the principle of the stomach-tube or a large rubber catheter is necessary. These may be introduced with the bougie or after the stricture has been enlarged. Galvanism and strychnine tend to cause contraction in incipient cases. The main object in all, however, should be to insure adequate alimentation. In advanced cases gastrotomy has proved of great value.

Tumors of the Œsophagus.

Carcinoma.

Symptoms.—Cancer of the œsophagus is rather frequently met with, and is attended by progressive stenosis, as already stated under the head of STRICTURE OF THE ŒSOPHAGUS. In some cases, however, the facies of the patient and cachectic symptoms denoting the involvement of other organs are first to appear. Pain is marked early in the cases; later on the tissue-destruction involves the nervous supply, and the pain is no longer experienced. Slight hæmorrhages may occur at this stage, though streaks of blood may have already been noted in the vomited matter. The cancerous process is then apt to invade the surrounding organs,—the larynx, the trachea, the bronchi and lung, the pleura,

the pericardium, and the larger vessels,—causing fatal hæmorrhage. The cervical glands are often enlarged. The vertebræ may be included in the destructive process and involvement of the cord, with paralytic symptoms, appear. Paralysis of the larynx may also occur through pressure on the recurrent laryngeal. Progressive emaciation begins early in the history of the case and death from exhaustion finally supervenes.

Diagnosis.—Progressive stenosis is a feature of all cases of stricture; hence the diagnosis must be based upon other symptoms. When the facies of the patient, a family history of cancer, and absence of local injury, syphilis, or tuberculosis can be recorded in a patient aged over 40 years, the likelihood that cancer is present is very great. Ejecta of portions of the mass will then reveal the characteristic histological features of cancer.

In the majority of cases, however, such clear signs cannot be obtained. Then pressure from a growth external to the œsophagus must be excluded; an aneurism, an enlarged gland, etc., may, as shown, cause stricture. If the stenosis is near the larynx it is rarely cancer, but a cicatricial stricture or an impacted foreign body. The auscultation test described may be employed and also the œsophageal bougie, but the latter must be used with extreme care. (See STRICTURE.)

Etiology and Pathology.—Almost all cases of cancer encountered in the œsophagus are of the squamous-epithelioma variety, the growth starting from the pavement-epithelium of the mucous membrane, most frequently in that of the lower third of the organ. It gradually invades the mucous membrane, and, progressing laterally, the lumen of the cavity is soon reduced by a ring-like

neoplasm. Later, the deep tissues become involved and the epithelioma, if the patient lives long enough, may extend to any of the important organs of the thoracic cavity.

Cancer occurs especially in males over 40 years of age. An inherited predisposition and an exciting cause—such as the prolonged use of alcohol, strong condiments, or an ulcer—are thought to afford the necessary conditions for its development.

Treatment.—This has been considered under the head of STRICTURE.

Neuroses.

Spasm of the Œsophagus (Œsophagismus).—**SYMPTOMS.**—Spasmodic contraction of the muscles of the œsophagus comes on suddenly, several attacks occurring in quick succession or intermittently, efforts to suppress them by swallowing saliva or food usually bringing them on. Deep-seated cramp-like pain is experienced during the spasm in the majority of cases. Food on its way down to the œsophagus may be regurgitated if still near the larynx; if below this it is retained *in situ*, until the spasm has passed. The attacks may last but a few hours and recur only after months' intervals; again, they may be persistent and render proper alimentation of the patient impossible without recourse to auxiliary means. Solids can, as a rule, be swallowed.

DIAGNOSIS.—The constriction usually occurs near one of the extremities of the œsophagus, but it may not be limited to these regions in succeeding attacks. Hysteria and other neuroses can usually be detected, especially in females, for whom the disease shows a predilection. The bougie may be used advantageously to distinguish œsophagismus from the organic lesions already described. In spasm the instrument will encounter a

stenosis during the active stage and pass down freely while no spasm is present.

ETIOLOGY.—Spasm of the œsophagus is the manifestation of a general neurosis, particularly hysteria, and is therefore observed in young females. It may occur as a symptom of tetanus, rabies, epilepsy, chorea, and other neuroses, and as a result of violent emotions,—fright, joy, etc. It may also be associated reflexly with pregnancy, and with disorders of the genital system, or of other organs, especially the neighboring ones,—the pharynx and the stomach. It often attends the various organic diseases of the organ itself.

TREATMENT.—Cessation of an attack is easily effected, in the majority of cases of hysterical œsophagismus, by means of antispasmodics,—the bromides, valerian, asafoetida, etc.,—but the first of these should only be used temporarily. The mere passage of the sound in these cases is often sufficient to arrest an attack. In all other forms the same remedies, with, in severe cases, hypodermic use of ether, atropine ($\frac{1}{120}$ grain), or morphine, if pain is present, are indicated during the access, constitutional treatment being instituted to counteract the causative disorder. In persistent cases the patient may require alimentation through the tube, and other measures outlined under STRICTURE.

Paralysis of the Œsophagus.—**SYMPTOMS.**—Paralysis of the œsophagus is rarely met with. There is functional inactivity of the muscular coat of the œsophagus and great difficulty is experienced in swallowing, the bolus remaining *in situ* if at all large. Liquids pass down with ease and are used by the patient to “wash down” small masses of solid food. The accumulation of food in the œsophagus often engenders dila-

tation, and the symptoms of the latter disorder are the predominating ones.

ETIOLOGY.—Paralysis of the œsophagus is usually due to extensive bulbar paralysis and other central nervous disorders. But it may also occur in a complication of peripheral disorders, especially diphtheria, enlarged lymphatic glands, and of syphilis, alcoholism, plumbism, etc.

TREATMENT.—The treatment indicated is that of the causative disorder. In diphtheritic paralysis arsenic is most effective. After a course of this remedy hypodermic injections of strychnine are often effective. Faradism, the negative pole in the sulcus directly in front of the sterno-mastoid and the positive back of the neck, may be simultaneously employed.

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OLIVE-OIL.—Olive-oil (*oleum olivæ*, U. S. P.) is a fixed oil expressed from the ripe fruit of *Olea Europæa* (nat. ord., *Oleaceæ*), or olive-tree, indigenous to the countries bordering upon the Mediterranean, but cultivated in all the semi-tropical countries of the world. It is yellow or greenish-yellow in color, has a sweetish taste, and is almost devoid of odor. The greenish-yellow-colored oil is considered the most delicate, and is rarely an article of export. The best, or virgin, oil is obtained from the crushed, ripe fruit, by expression without heat; a second grade is obtained by the addition of hot water to the same crushed fruit and a second expression. From the residue, after boiling, an inferior grade is made by means of very strong pressure. The best is nearly tasteless, and without color, the second has more taste and color, and the third is dark and more

or less rancid, with strong odor. Olive-oil is one of the ingredients of lead plaster and of diachylon ointment, and is also used in the preparation of liniments and cerates. Olive-oil is soluble in ether, chloroform, and carbon disulphide, and partly in water.

Therapeutics. — Olive-oil is a lubricant, laxative, and nutrient. Internally and by enema it is given for constipation, in doses of from $\frac{1}{2}$ to 6 ounces. It is a useful remedy in all forms of irritant poisoning, except that by phosphorus. In increasing doses from $\frac{1}{2}$ to 3 ounces it has caused the disappearance of obstructive jaundice. It has been used in the treatment of gall-stone, hepatic, and lead colic in doses of 3 to 6 ounces.

Two cases of hepatic colic treated with large quantities of olive-oil. Pain was relieved at once and the calculi were rapidly discharged. It is believed that the oil not only soothes the irritated mucous membrane and relieves spasm in this way, but may even enter the common duct when this is blocked and there is no descending current of bile, and may thus reach the stone and aid in its passage by its local action on the mucous membrane. Barth (*Med. Week.*, Dec. 17, '97).

Olive-oil is a useful application to the skin in scarlatina and other eruptive diseases, as it seems to assist desquamation and prevents the dissemination of the scales.

Olive-oil has been used by inunction, or as an article of diet, in wasting diseases. For this purpose it is much inferior to codliver-oil. It has recently been used hypodermically as a nutrient to supplement or replace codliver-oil in case of needed rectal alimentation.

More than five hundred subcutaneous injections of olive-oil, all made in twenty-eight patients, with never any unfavorable results, the oil being always carefully sterilized and injected with an instrument which could be fully steril-

ized. Injections should be made very slowly, always using a very low pressure. Amount used varied from 1 drachm up to $1\frac{1}{2}$ ounces. Conclusions that the fat was absorbed and was made use of in the body-economy, it was not excreted by the urine, and it seems to have prevented loss of nitrogen. This subcutaneous administration of fat should be used when there is great loss of body-fat. Du Mesnil de Rochemont (*Deut. Arch. f. klin. Med.*, Apr. 7, '98).

In chronic dysentery excellent results have followed the continued use of olive oil given in large quantities. Starting with a dose of one ounce three times a day, this is gradually increased to four ounces. Very little objection is made to the taste of the oil, and after a short time patients develop a liking for it. The beneficial results obtained are ascribed by some observers to a supposed stimulation of the secretion of bile. In the very difficult condition of gastric ulcer, Cohnheim has long relied on olive oil as an adjunct in treatment. He believes that it relieves pain, lubricates surfaces of ulcers or fissures, reduces hyperacidity, and acts as an easily digested food. In employing olive oil, one should take precautions to make sure that the olive oil is pure, as in commerce it is commonly adulterated to a large extent with cottonseed oil, a body whose therapeutic and nutritive qualities have not been fully examined. (*Medical Press and Circular*, April 27, 1904.)

Externally olive-oil is a soothing application to burns, wounds, and raw surfaces. Dropped into the ear, it is a useful means for expelling insects that may have found their way thence.

Subcutaneous injections of olive-oil successfully employed in cases in which food could not be taken by the mouth. The apparatus should be such that it can be thoroughly sterilized. The injections should be under as low a pressure as possible in order to avoid pain, and into a part covered with loose skin. The oil is taken up slowly, but in emaciated subjects absorption is complete within two

or three days. Rochemont (Deutsches Archiv f. klinische Medicin, B. 60, H. 4 u. 5, '99).

OPIUM AND DERIVATIVES. —

Opium (U. S. P.) is the concrete, milky exudation obtained by incising the unripe capsules of *Papaver somniferum* (nat. ord., *Papaveraceæ*), or white poppy-plant, which is indigenous to Asia Minor, but is now grown in many other parts of the world. It occurs in moist semi-solid chestnut-colored masses, or lumps, with an earthy, narcotic odor and a bitter taste. The crude drug should contain not less than 9 per cent. of crystalline morphine; when dried or powdered it should contain not less than 13 per cent. nor more than 15 per cent. of morphine.

The principle properties of opium are extracted by water, alcohol, and by dilute acid, but not by ether.

The chemical composition of opium is very complex. Seventeen alkaloids have been found in it, also meconic and lactic acids, and meconin, meconoisin, and porphyroxin, neutral substances, and glucose. The alkaloids found in this drug are morphine, codeine, narcotine, thebaine, narceine, papaverine, pseudomorphine, laudanine, hydrocotarnine, cryptopine, protopine, codamine, rhœadine, meconidine, laudanosine, lanthopine, and gnoscopine.

MORPHINE (at least 9 per cent. in crude opium) is the principle narcotic constituent. It occurs in white prisms of silvery lustre and bitter taste, and is soluble in amyl-alcohol, in 300 parts of alcohol, in 4000 parts of ether, and in 5000 parts of water. It unites with the acids to form soluble salts.

Morphine acetate occurs as a yellowish-white powder, which turns brownish and loses acetic acid with age. It has

an acetic-acid odor and is soluble in $2\frac{1}{2}$ parts of water.

Morphine hydrochlorate occurs in white, crystalline squares, or fine, white needles, having a bitter taste, and is soluble in 24 parts of water and in 62 parts of alcohol.

Morphine meconate, or bimeconate, is the form in which most morphine exists in opium; it occurs as a feeble yellowish-white, crystalline powder, which is soluble in alcohol and in 25 parts of water and is reputed to produce a less agreeable effect upon the brain, stomach, and intestines than the other salts.

Morphine sulphate, the salt most used in the United States, occurs in fine, white, crystalline needles, of silky lustre and bitter taste, it is soluble in 21 parts of water and in 702 parts of alcohol.

CODEINE (0.5 per cent. in crude opium) possesses about one-half the narcotic strength of morphine, but is more calmative. It occurs in colorless, bitter, alkaline crystals, which are soluble in alcohol, ether, benzene (benzol), carbon disulphide, and in 80 parts of water. It is chiefly used as a calmative in diseases of the respiratory organs, as an hypnotic, and against pains of moderate or slight severity. It forms salts with the acids, but the alkaloid itself is generally used. The phosphate is soluble in 4 parts of water and is the best for hypodermic use, as it is more soluble and less irritating than the other salts.

APOCODEINE is a derivative of codeine, having expectorant and emetic properties. It occurs as a reddish-brown, amorphous powder, soluble in ether, alcohol, and chloroform. Apocodeine hydrochlorate occurs as a yellow-gray, very hygroscopical powder, freely soluble in water. Apocodeine acts like codeine, but is weaker; it produces a marked increase in the salivary secretion and an accel-

erated peristaltic action of the bowel. It is used as an expectorant and sedative in chronic bronchitis and other bronchial affections.

NARCOTINE (2 to 10 per cent. in crude opium) has no narcotic effects, but is an antiperiodic. It has very weak basic power, forming, however, a sulphate and hydrochlorate, which occur in white or yellowish-white, amorphous powders, soluble in water.

THEBAINE, OR PARAMORPHINE (less than 0.25 per cent. in crude opium), is a spinal convulsant. It occurs in white, lustrous crystalline scales, having a sharp, styptic taste, and is soluble in 10 parts of chloroform and in 140 parts of ether. It is very poisonous. The tartrate is freely soluble in water; the hydrochlorate is soluble in $15\frac{1}{2}$ parts of water.

NARCEINE (0.02 per cent. in crude opium) occurs in very fine small, feather-like needles, which are soluble in alcohol and in hot water. It forms salts, but the alkaloid is generally used. It is used like morphine; its action, though similar to that of morphine, is milder and free from disagreeable after-effects.

PAPAVERINE (1 per cent. in crude opium) is a narcotic and sedative used principally in the diarrhoea of children. It occurs in white prisms, soluble in alcohol, ether, and chloroform. It forms the usual salts with the acids.

PROTOPINE, according to Engel (Gaz. Méd. de Paris, Oct. 11, '90), acts similar to camphor, death occurring, after poisonous doses, from respiratory paralysis.

LAUDANINE appears to act principally upon the spinal cord, causing at first tetanus and afterward paralysis (Fubini and Benedicenti).

APOMORPHINE is a derivative of morphine, devoid of narcotic effect; it is an emetic, expectorant, and cardiac depressant. (See "APOMORPHINE," volume i.)

DIONIN is a new morphine derivative, recommended by Hesse (Pharm. Centralh., xl, p. 5, '99). It is the hydrochlorate of morphine mono-ethyl-ether, or ethyl-morphine. Dionin is serviceable, therapeutically, because it affords neutral solutions which may be advantageously employed subcutaneously. It is soluble in about 7 parts of water, in about 1.4 parts of alcohol, and in about 20 parts of syrup, while it is insoluble in ether and in chloroform.

HEROIN constitutes another derivative. If acetyl groups are substituted for the two hydroxyl groups of morphine, heroin is produced. Its sedative action on the respiration is said to be more powerful than that of morphine and codeine. The fatal dose of heroin is 100 times the efficacious dose, while the fatal dose of codeine is only 10 times the efficacious dose. Heroin has very little convulsive action.

Peronin is a preparation of which the cardio-depressant effects are so marked as to exclude its use, inasmuch as its therapeutic value is not superior to that of codeine or of dionin. Dionin and codeine, on the other hand, are drugs which represent a permanent addition to the armamentarium. Dionin is in some respects preferable to codeine. It is more soluble, and used hypodermically is painless. It does not produce the euphoria so characteristic of morphine, and, in a less degree, of codeine. Hence there is far less danger of habit-formation. The narcotic effects are also less pronounced in case of dionin than in any of the other drugs of the group studied. Thus, as an anodyne and as a soporific dionin is of vastly inferior importance. On the other hand, it seems to exercise a specific and selective action upon the sensory terminations in the trachea and bronchi. It controls all forms of irritative and superfluous cough; it regulates respiration; it diminishes the feeling of dyspnoea. In other words, it fulfills the same indications as does

codeine, but produces less of the psychological effects of that drug. The properties of heroin place it midway between dionin and codeine, on the one hand, and morphine, on the other. A powerful respiratory sedative, it produces at the same time a considerable degree of euphoria and of somnolence. It has a well-marked depressant action upon the heart and the vasomotor system. The practitioner has thus at his command a set of alkaloids which produce a graded series of effects of a very definite character. Mayor (*Revue Méd. de la Suisse Rom.*, March, 1902).

PERONIN is an hydrochlorate of benzylmorphine. It possesses very feeble narcotic properties, notwithstanding the fact that it has a marked sedative action on the respiratory tract. It is therefore useful in the treatment of cough-producing conditions.

Preparations and Doses.—Opium preparations in solution are precipitated by the solutions of many metallic substances in the form of an insoluble meconate (*e.g.*, lead-water and laudanum). The alkaloids in solution are precipitated by the addition of an alkali or of tannic acid. The presence of a small portion of glucose in opium makes it incompatible with nitrate of silver, and pills containing them in combination may explode.

OFFICIAL SOLID PREPARATIONS.—*Emplastrum opii* (extract of opium, 6 per cent.).

Extractum opii (18 per cent. morphine), $\frac{1}{4}$ to $\frac{1}{2}$ grain.

Opium pulvis (13 to 15 per cent. of morphine), $\frac{1}{2}$ to 2 grains.

Opium (at least 9 per cent. morphine), $\frac{1}{4}$ to 2 grains.

Opium deodoratum (14 per cent. morphine), $\frac{1}{2}$ to 2 grains.

Pilulæ opii (powdered opium, 1 grain), 1 pill.

Pulvis ipecacuanhæ et opii (Dover's

powder—ipecac and opium, each, 1 part; milk-sugar, 8 parts), 5 to 15 grains.

Trochisci glycyrrhizæ et opii (Wistar's cough-lozenges—extract of licorice, 2 grains; extract of opium, $\frac{1}{20}$ grain; acacia, sugar, oil of anise, of each, a sufficient quantity), 1 to 10 troches.

OFFICIAL FLUID PREPARATIONS.—*Acetum opii* (vinegar of opium, or black drop—10 per cent. opium), 5 to 20 minims.

Mistura glycyrrhizæ composita (brown mixture—extract of licorice, sugar, acacia, of each, 3 parts; paregoric, 12 parts; antimonial wine, 6 parts; spirit of nitrous ether, 3 parts; water, 70 parts), 1 to 4 drachms.

Tinctura ipecacuanhæ et opii (fluid Dover's powder—1 per cent. ipecac; 10 per cent. opium), 5 to 15 minims.

Tinctura opii (laudanum—10 per cent. opium), 1 to 20 minims.

Tinctura opii camphorata (paregoric—0.4 per cent. opium), 1 to 4 drachms.

Tinctura opii deodorati (McMunn's elixir, or deodorized laudanum—10 per cent. opium), 1 to 20 minims.

Vinum opii (Sydenham's laudanum—10 per cent. opium), 5 to 20 minims.

OFFICIAL PREPARATIONS OF THE ALKALOIDS OF OPIUM.—*Apomorphinæ hydrochloras* (derivative of morphine), $\frac{1}{16}$ to $\frac{1}{8}$ grain.

Codeina (alkaloid), $\frac{1}{4}$ to 3 grains.

Morphina (alkaloid), $\frac{1}{16}$ to $\frac{1}{4}$ grain.

Morphinæ acetas, $\frac{1}{12}$ to $\frac{1}{2}$ grain.

Morphinæ hydrochloras, $\frac{1}{12}$ to $\frac{1}{2}$ grain.

Morphinæ sulphas, $\frac{1}{12}$ to $\frac{1}{2}$ grain.

Old people, especially those with arteriosclerosis, have a special intolerance toward morphine. When giving opiates to old people for the first time the dose of morphine should be $\frac{1}{20}$ grain, and of opium $\frac{1}{12}$ to $\frac{1}{8}$ grain. Hypodermically, morphine should be given to the aged only after we are sure that they have

no intolerance for the drug. Tauszk (Merck's Archives, June, 1901).

Pulvis morphinæ compositus (Tully's powder—morphine sulphate, 1 part; camphor, licorice, and calcium carbonate, of each, 20 parts), 5 to 15 grains.

Trochisci morphinæ et ipecacuanhæ (morphine, $\frac{1}{40}$ grain; ipecac, $\frac{1}{12}$ grain), 1 to 6 troches.

NON-OFFICIAL SOLID PREPARATIONS.—*Apocodeina* (alkaloid and hydrochlorate), 3 to 4 grains daily (in divided doses).

Confectio opii (U. S. P., 1870—powdered opium, 1 part; aromatic powder, 12 parts; honey, 28 parts), 10 to 20 grains.

Dionin (soluble in 7 parts of water), $\frac{1}{6}$ to $\frac{1}{2}$ grain.

Heroin (very slightly soluble), $\frac{1}{12}$ to $\frac{1}{3}$ grain.

Narceina (alkaloid), $\frac{1}{4}$ to $\frac{3}{4}$ grains.

Narcotinæ hydrochloras, 2 to 10 grains.

Papaverina (alkaloid), $\frac{1}{12}$ to $\frac{3}{4}$ grain (to a child).

Papaveris capsulæ (poppy-capsules—strength variable).

Peronin (soluble in 133 parts of water), $\frac{1}{6}$ to $\frac{2}{3}$ grain.

NON-OFFICIAL FLUID PREPARATIONS.—*Liquor morphinæ bimeconatis* (B. P.), 5 to 40 minims.

Liquor morphinæ sulphatis Majendie (16 grains to fluidounce), 3 to 10 minims by hypodermic injection.

Mistura magnesiæ et asafœtidæ (Dewee's carminative—magnesium carb., 5 parts; tincture of asafœtida, 7 parts; tincture of opium, 1 part; sugar, 10 parts; water, to make 100 parts), $\frac{1}{2}$ to 4 drachms.

Mistura opii et ipecacuanhæ compositus (Swedish cholera drops, or Thielemann's cholera drops), 1 to 2 drachms.

Morphinæ oleatum (10 per cent. morphine), for external use.

Oleum papaveris seminis (poppy-seed-oil—bland oil; adulterant of olive-oil).

Syrupus papaveris (syrup of poppy-capsules—strength variable).

Syrupus rhœados (syrup of red poppy-flowers—non-narcotic), used as vehicle.

Tinctura chloroformi et morphinæ, B. P. (chloroform, $1\frac{1}{4}$ minims; ether, $\frac{1}{3}$ minim; alcohol, $1\frac{1}{4}$ minims; morphine hydrochlorate, $\frac{1}{48}$ grain; dilute hydrocyanic acid, $\frac{5}{8}$ minim; oil of peppermint, $\frac{1}{80}$ minim; fluid extract of licorice, $1\frac{1}{4}$ minims; treacle and syrup, to make 10 minims), used externally.

Physiological Action.—One of the main factors in the physiological action of opium is its inhibitory influence upon tissue-waste. The reduced elimination of urea and other waste-products attending its use tend to practically sustain the results of experimental researches. Its baneful influence upon gastric digestion and intestinal action is, in part, due to this effect, which involves depression of motor activity. The slowing of the pulse noted is at present ascribed to stimulation of the pneumogastric, and therefore of the inhibitory powers of this nerve upon cardiac action; the drug is also credited with a stimulating effect upon the muscles of the heart itself. When a powerful dose is taken the conditions are reversed; the inhibitory influence of the vagus is counteracted, the vasomotor centres are depressed and a rapid pulse and marked depression follow. The same influence obtains upon the temperature, which may be slightly raised by small doses and lowered by large ones. Respiration follows suit, large doses of opium acting powerfully upon the respiratory centres. What its well-known influence upon the pupil depends upon is not clearly defined, but

it is theoretically ascribed to its depressing effects upon the sympathetic system. The same influence upon the splanchnic nerves reduces peristaltic action indirectly, and gives rise to constipation; large doses, by totally paralyzing these inhibitory fibres, may thus totally arrest intestinal activity. A large proportion of opium when taken by the mouth is absorbed from the stomach; hence the importance of washing out this viscus in cases of acute poisoning. The intestines and kidneys are the main channels of elimination for what proportion of the drug ingested or absorbed after hypodermic use is not destroyed in the organism.

Acute Poisoning by Opium.—Acute poisoning by opium may occur by intent or accident, through an overdose of one of the official preparations of opium or morphine, but not infrequently through the careless use of certain proprietary medicines. Children, being very susceptible to the action of opium, are often profoundly affected by seemingly small and appropriate doses. Soothing syrups and carminatives containing opium have contributed their share in increasing infant-mortality. Idiosyncrasy, in the adult, will sometimes cause profound effects to follow the administration of a moderate dose of this drug.

A full dose of opium or one of its preparations is followed by a well-defined train of symptoms. We notice first a preliminary stage of mental excitement, which is accompanied by a feeling of well-being and content and an acceleration of the heart's action. This is soon followed by headache, weariness, a sensation of weight in the limbs, and drowsiness. With these feelings we observe a diminished sensibility of the skin, contracted pupils, deeper and slower respiration (sometimes not more than eight to

ten to the minute); slow, full pulse; suffused or even cyanotic face; and warm, dry skin. The breathing may now become puffing and stertorous. In this stage the person may be aroused by being loudly called or violently shaken; but if left alone he falls asleep at once. When the patient is aroused, the respirations become more frequent, the blood better aerated, and the duskiness of the face disappears. Death seldom, if ever, occurs in this stage from the action of the poison alone, but death may take place if a complicating disease be present.

If the dose taken be a lethal one, the symptoms increase in severity. The face becomes at first more cyanotic, then, as death approaches, pale and livid. The pupils contract to the size of a pin's point. The respirations now drop to four or five per minute, and become irregular and shallow. The pulse becomes weak and compressible; the skin cold and covered with a clammy perspiration. There is complete muscular relaxation; the lower jaw drops. The reflexes are abolished. The patient cannot now be aroused. Death occurs by respiratory paralysis, although, on account of the asphyxia, the heart ceases its action almost simultaneously. Dilatation of the pupils is found only after death. Death, in the adult, has followed the ingestion of $2\frac{1}{2}$ grains of the extract of opium, 4 grains of powdered opium, 1 grain of morphine, and 1 drachm of laudanum. The amount that can be taken without producing death by those habituated to its use is incredible. Taylor reports the death of a child of 4 weeks of age after taking $2\frac{1}{2}$ minims of paregoric.

(For the symptoms and treatment of chronic poisoning by opium, see MORPHINISM.)

Several fatal cases of opium poisoning have, after being unconscious for a long

time, opened their eyes, moved their hands, and shown other signs of returning consciousness, but died almost immediately afterward. Carl Johnson (Med. News, May 19, '94).

Case of idiosyncrasy to codeine reported. Patient was given $\frac{1}{2}$ grain internally and $\frac{1}{2}$ grain by hypodermic injection. In about an hour the patient was swelled from head to foot, face and body intensely red, as if stung by bees, and skin so hyperæsthetic that the slightest touch on any part of it caused her to cry out with pain. The lower extremities were cold and purple, with a death-like feeling, the heart-sounds feeble and irregular, and the pulse at the wrist almost imperceptible. Large doses of digitalis and whisky, with hot applications to feet and limbs, soon restored the failing circulation. In five or six hours she felt as well as if nothing had occurred. J. S. Duff (Columbus Med. Jour., June, '94).

Differential Diagnosis of Acute Poisoning by Opium.—Some cases of acute poisoning by opium bear a close resemblance to cases of uræmic coma, alcohol intoxication, and cerebral apoplexy (especially hæmorrhage into the pons Varolii). In all these conditions we may have coma, stertorous breathing, slow respiration and pulse, and congestion of the face. The history of the case may or may not aid us. In uræmic coma there is generally more or less œdema present. The presence of albumin and casts would point to uræmia, but albumin may be present in the urine after an apoplectic seizure or an intracranial hæmorrhage, although the kidneys were in a perfectly healthy condition prior to the attack. Alcoholic intoxication may be suspected from the odor of spirits or of ethers on the breath or about the person. In alcoholic intoxication the patient can be roused and will answer questions. The pupils may be contracted in acute alcoholism, but will dilate when the patient is aroused. The possibility of double poi-

soning by opium and alcohol should be borne in mind. In cerebral apoplexy, except where hæmorrhage has invaded the pons Varolii, the pupils are not contracted or are unsymmetrical; there is strabismus, sometimes facial asymmetry, and usually paralysis of one limb or both. In apoplexy the onset of the symptoms is sudden, there is often no history of having taken food or medicine, and the face, although congested or pale, is not swelled and cyanosed as in opium narcosis. Hæmorrhage into the pons Varolii is rare and generally fatal; the attack is sudden and the entire body is relaxed, with involuntary evacuations of bladder and bowel, which is not usual in opium poisoning.

In the third stage opium poisoning is sometimes differentiated with great difficulty from uræmic coma, alcoholic narcosis, cerebral hæmorrhage, and the condition following an epileptic convulsion. In uræmic coma the pupils are usually normal or dilated, but may be contracted; convulsions generally occur, and anasarca is usually present. The urine is always loaded with albumin, and the temperature is said to be always below normal. In alcoholic narcosis the pupils are normal or dilated, the respirations are not as slow as in opium poisoning, and the pulse is slow and full. Too much dependence must not be placed upon the odor of alcohol, as the patient may have taken opium while intoxicated. An hypodermic injection of apomorphine will cause a man unconscious from alcohol to vomit, but will have no effect if the case be one of opium poisoning. In case of cerebral hæmorrhage there is usually more or less paralysis of the cranial nerves, with some differences in the reflexes of the two sides of the body, and in the size of the two pupils. In the coma following an epileptic convulsion the tongue will probably be bitten, the pupils dilated, and the respirations but little slower than normal. The history and surroundings are often more valuable aids to diagnosis than the physical condition. The occur-

rence of a convulsion at the beginning of the attack will exclude opium poisoning, although it may occur in anyone of the other conditions named. Carl Johnson (Med. News, Mar. 20, '97).

Three cases, including a personal one, in which death followed the administration of morphine after chloroform anæsthesia. Lauwers (Jour. de Chir., March-April, 1901).

Treatment of Acute Poisoning by Opium.—The first indication is to empty and wash out the stomach. Emetics may be used, but large doses will be required. The stomach-siphon is preferable if it can be used. By means of it antidotes can be introduced into the stomach as soon as it is washed out. Since opium is eliminated into the stomach from the blood-vessels and then reabsorbed by it, frequent lavage of the stomach is advised. Tannic acid and permanganate of potash are chemical antidotes to opium, and a solution of one of these may be placed within the stomach by means of the stomach-siphon. Permanganate of potash, if given while the poison still remains in the stomach, will decompose the morphine. A quantity of the permanganate at least equal to the amount of morphine swallowed should be administered, well diluted with water, as recommended by William Moor, of New York, who first suggested this valuable antidote. Many instances of success with this remedy have been reported.

One grain of morphine is decomposed by exactly 1 grain of permanganate of potassium. This should be the basis of the permanganate treatment of opium poisoning. No matter how much time has elapsed since the taking of the poison, a sufficient quantity of the antidote should be given *per os* (well diluted), or, if the patient be unable to swallow, the permanganate solution can easily be administered through the nose by means of a catheter, piece of rubber tubing, and a funnel. Hypodermically,

a 1 to 15 solution can be used. The *modus operandi* of hypodermic injections of permanganate of potassium, in cases of morphine poisoning, is explained by the fact that the permanganate instantaneously selects morphine from among albuminous bodies. William Moor (Med. Rec., Feb. 17, '94).

Potassium permanganate given by the mouth directly after poisoning is a valuable, but not perfect, antidote to the morphine salts: an antidote, however, which should not be relied upon to the exclusion of mechanical or medicinal measures for emptying the stomach. H. C. Wood (Univ. Med. Mag., Aug., '94).

Case of a child, aged 18 months, poisoned by 2 morphine pills, $\frac{1}{4}$ grain each. About 1 grain of potassium permanganate was given at once, no other agent, not even an emetic being resorted to. A second grain was given and the little patient put to bed. During the night the child had some delirium of a wild nature and had little sleep, but next day appeared none the worse for its overdose of morphine. H. B. Tingley (Med. Rec., Nov. 3, '94).

Thirty-five cases of opium poisoning in which potassium permanganate has proved its great value.

The physician should at once administer a sufficient quantity of the permanganate on reaching the bedside, while in ambulance cases the surgeon should first administer the potash salt before conveying the patient to the hospital, otherwise the jolting of the vehicle promotes the absorption of the poison. William Moor (Med. Rec., Mar. 2, '95).

Case in which the permanganate was used successfully by hypodermic injection, 3 grains being given in that way every hour until 12 grains had been given. Hayes (N. Y. Med. Rec., May 25, '95).

Treatment of opium poisoning by permanganate of potassium employed in 19 cases, the following solutions being used:—

No. 1 solution:—

R Potass. permang., 10 grains.
Acid. sulph. dil., 2 drachms.
Aq., 1 pint.

As this does not keep well, the sulphuric acid has to be kept separately, and the quantities in the stock mixtures are so arranged that 2 drachms of the permanganate and 2 drachms of the sulphuric acid in the concentrated solution, added to a pint of water, provide the proper amount for use.

No. 2 solution:—

℞ Potass. permang., 2 grains.
Aq., 1 pint.

This is also kept in a concentrated stock mixture. The following instructions are carried out regarding the use of the stock solutions:—

1. The stomach is to be washed out twice with plain water, washings being kept for chemical examination.

2. Stomach is washed out with No. 2 solution until washings come back pink, the solution being retained in the stomach for 1 minute each time.

3. The No. 1 solution is introduced and left in the stomach.

4. No. 1 solution is to be repeated twice, at intervals of half an hour.

5. Then No. 2 solution is to be given every half-hour until complete recovery.

It is better to use a tube entirely open at the stomach end—an ordinary half-inch drainage-tube answers the purpose. The amount of permanganate required depends upon the amount of drug taken. The washings must be continued until the solution returns pink. Maynard (*Brit. Med. Jour.*, May 16, '96).

More than 90 instances of successful use of potassium permanganate in opium poisoning have been reported. Seven or 8 grains in diluted solution should be given to antidote the opium or morphine in the stomach, and this is to be followed by 1 grain in solution at frequent intervals, to antagonize the morphine subsequently eliminated by the gastric mucous membrane. The subcutaneous injection of a 1-per-cent. solution is also recommended as a physiological antidote. Moor (*Ther. Woch.*, No. 7, '97).

There are but three possible ways in which potassium permanganate may overcome the poisonous effects of opium: 1. Chemically, by coming in contact with

the alkaloids in the blood, and thereby oxidizing them. 2. By acting as a physiological antagonist. 3. Mechanically, by giving rise to severe pain, which follows the ingestion of potassium permanganate, thereby assisting in keeping the patient awake. Experiments tried on dogs lead to most serious doubt as to the efficacy of potassium permanganate as an antidote to opium or any of its alkaloids when hypodermically injected. E. Q. Thornton and C. A. Holder (*Ther. Gaz.*, No. 1, p. 11, '98).

In morphine poisoning good effects obtained by the sodium salt are shown to be not inferior to those of the potassium salt. The stomach should be previously washed out with a 0.2-per-cent.-sodium-permanganate solution. This should be done even if the poison have been taken some hours previously. After this, half a litre of the same solution is taken, or it may be passed through the tube into the stomach. The washing out should be repeated again in a few hours. If washing out is not possible, apomorphine should be injected, as emetics administered by the mouth interfere with the permanganate. Where the emetic must be given by the mouth, half a litre of sodium permanganate is given immediately afterward, and then another half-litre after the vomiting. The usual remedies must not be omitted if there be any evidence of absorption having taken place from the stomach, because permanganate is of little service after the poison is absorbed. Schreiber (*Centralb. f. Inn. Med.*, June 11, '98).

In morphine poisoning coma is very quickly relieved by the introduction of ice into the rectum. It was found also useful in chloral poisoning, suffocation from coal-gas, and diabetic coma. Willis Cummings (*Merck's Archives*, Mar., 1901).

Tickling the patient is a very efficient procedure, much more so than flagellation, and less cruel. It acts remarkably, not only wakening the patient, but angering him nearly to the point of fighting. W. H. Lyne (*Va. Med. Semi-monthly*, No. 22, 1901).

Four cases of morphine poisoning, in which potassium permanganate was em-

ployed hypodermically, a 10-per-cent. solution being used. In one of the cases some time elapsed before potassium permanganate could be procured, the patient having in the meantime become so deeply unconscious as to make all attempts at arousing him futile. Five grains (0.33 gramme) of the antidote in solution were administered by the mouth, but he immediately vomited the dose. An injection containing 2 grains (0.13 gramme) of the salt was now given in the scapular region and repeated. Half an hour afterward the man could be aroused. The injections were repeated every ten minutes for six times, and the patient kept awake for three hours, when he was out of danger. With the exception of a very sore back, due to the injections, his recovery was uneventful. T. H. Marable (Medical Age, Oct. 25, 1901).

Hot, strong, black coffee is useful in keeping up the respirations and averting collapse. It is usually given by the mouth, if the patient can swallow; if not, by means of the stomach-siphon or by rectal injection. If the respiration become too infrequent the hypodermic injection of strychnine ($\frac{1}{30}$ to $\frac{1}{10}$ grain) will be found useful, and may be repeated as the symptoms demand.

Alcoholic stimulants may be required. Ammonia and respiratory stimulants—amyl-nitrite, atropine, etc.—may prove ineffectual, and recourse may then be had to artificial respiration. If the surface temperature fall, external heat to the trunk and the extremities will assist in maintaining the body-heat. While opium coma does not in itself kill, the patient may in that state cease breathing, and as any method of rousing the patient will accelerate and deepen the respiratory action, it is important that the patient be kept awake by continuously walking him between two assistants or by flagellation. As death occurs by paralysis of the respiratory centres, the maintenance of respiratory action should be our chief aim,

and eternal vigilance should be observed until all danger is over.

Case of opium poisoning in a year-old child, to whom the mother by mistake administered a teaspoonful of Sydenham's laudanum. The father immediately gave the child as much milk as it could take, and afterward a tablespoonful of syrup of ipecac. The milk, coagulating in the stomach, imprisoned the laudanum and the ipecac caused it to be vomited in the curds. The child's life was thus saved without any symptoms of poisoning, absorption not having taken place on account of the coagulation of the milk. Gibert (Union Méd. du Nord-est, Apr., '94).

Venesection in opium poisoning is efficacious in apparently hopeless cases, where death is impending, owing to failure of respiratory action due to distension of the right side of the heart with backward pressure. D. G. Marshall (Indian Med. Gaz., June, '96).

Case of opium poisoning in which the patient swallowed a solution containing about 30 grains of morphine acetate, and was not discovered until three hours later. The pupils were contracted, pulse slow, and respirations slow and shallow. Patient rapidly grew worse, and, in spite of washing out the stomach, hypodermic injections of various stimulants, and application of faradism, cyanosis became profound, and death seemed imminent. Oxygen was then given and artificial respiration commenced; six hours later there was a slight attempt at respiration, and, at expiration of two hours more, artificial respiration was temporarily discontinued; 18 hours after the ingestion of the poison the patient was practically out of danger, and ultimately recovered. This is believed to be the largest dose followed by recovery hitherto recorded, considering the fact that the drug was taken upon an empty stomach, and no treatment employed for three hours. It is thought the oxygen alone saved the patient's life. D. T. Playfair (Lancet, Aug. 27, '98).

Case of accidental administration of a fluidrachm of liquor morphinæ (B. P.) to a 3-month-old baby. Within ten minutes child was seized with violent tetanic

convulsions and with periodic cessation of breathing. Pupils were contracted to pin-point. Later child was comatose. Artificial respiration was continued constantly for three hours and occasionally for the succeeding six or seven. Within an hour child was given $\frac{1}{300}$ grain of atropine, subcutaneously; half an hour later $\frac{1}{150}$ grain. Twice afterward $\frac{1}{300}$ grain was administered. Strong decoction of coffee and peptonized milk were given by the rectum, and fomentations were applied to the epigastrium. Face, upper part of chest, and other accessible parts were slapped with cold, wet towels. Child opened its eyes at the end of twenty-four hours, and not before forty-eight hours would it suck from the mother. At this time broncho-pneumonia developed, from which the child recovered entirely in ten days. J. Fotheringham (Brit. Med. Jour., Oct. 22, '98).

Though valuable in some cases of morphine poisoning, atropine is often useless or positively harmful. They are not only not antagonists in many important respects, but rather synergistic. Both are narcotics; both first excite and then depress the respiratory centre and the heart; both cause motor depression, produce sleep, and lead to paralysis and convulsions in sufficiently large doses, etc. It may be useful in morphine poisoning, but only before the stage of coma, and even then only in small or moderate dosage. Given in large doses during the stage of depression it is positively harmful by intensifying the action of the morphine. E. T. Reichert (Therap. Monthly, 1, No. 1, 1901).

Therapeutics.—Opium is used to relieve pain, to check inflammation and allay irritation, to produce sleep, to inhibit undue action of the organs of secretion, and to relieve the effects of systemic strain and shock. In meeting these indications it covers an extensive field—so extensive, indeed, that the reader must be referred to almost all the affections considered in this work, to properly portray its usefulness. To repeat all these indications under this head would require about fifty pages,

which the editor rightly prefers to devote to new matter.

Heroin is not so harmless as was formerly supposed. It has a far greater depressant action on respiration than is seen in the case of morphine. Heroin is also a cardiac depressant, and in addition gives rise to muscular twitchings and convulsions. The maximum adult dose at present should not exceed $\frac{1}{14}$ grain. Harnack (Münchener med. Woch., July 4, '99).

Heroin is a very valuable therapeutic agent. It principally allays cough and eases respiration, but it has also general analgesic properties which render it of benefit in most painful affections. Except slight dizziness and occasionally dryness in the throat, which was personally found but rarely, no unpleasant symptoms even from a prolonged use of heroin have been seen. Max Einhorn (Phila. Med. Jour., Oct. 28, '99).

Heroin hydrochloride, a neutral salt of heroin, a new morphine derivative, is a white, odorless, crystalline powder of slightly bitter taste, freely soluble in water, acetic and dilute sulphuric acids. Its action in relieving cough and dyspnoea is prompt; and its ready solubility renders it peculiarly suited for hypodermic administration, especially where immediate results are required.

Respiration is profoundly influenced in all cases. There is a decided diminution in the frequency of the respiratory movements, with a prolongation of the inspiration and an increase of the force of expiration. The elimination of bronchial secretion is promoted, thus aiding in the relief of dyspnoea. The pulse becomes slightly diminished in frequency and likewise somewhat fuller. In therapeutic doses there is no disturbance of the gastric functions. Except for a slight nausea noticed in one case, no ill effects were observed. Its action on the intestine seemed to be a slightly constipating one.

The drug is well borne in both the young and the old, especially so in the former. As an anodyne in painful affections, it ranks much below either morphine or codeine.

The after-effects personally noticed

have been a slight nausea in one case, dizziness in two cases, languidness in two cases, and a pharyngeal irritation, with constant desire to clear the throat. None of these sequelæ was of a serious nature.

In cases marked by a diminution in the expectoration the drug may with advantage be combined with either the iodide of potash, ipecac, terpin hydrate, or squill. In cases attended with constipation the addition of cascara sagrada is effective.

The average dosage by mouth is from $\frac{1}{24}$ to $\frac{1}{8}$ grain, three times daily. It is preferably given after meals, especially when there is a diminution of gastric secretion, in which condition if dissolved in an acid medium and taken after the ingestion of food it fulfills all requirements. It may be given in powder, pill, tablet, or solution. After the prolonged use of the drug, as in tuberculosis, larger doses are required. For prompt effect it is employed by hypodermic injection. Four to 8 minims of a 2-per-cent. solution represent $\frac{1}{12}$ to $\frac{1}{8}$ grain, the smaller dose being the average amount necessary. The incompatibilities to its use internally are alkalies and apomorphine. Benno Hyams (Med. News, Dec. 1, 1900).

Heroin and heroin hydrochloride can be used with very good results in all disorders of the respiratory organs; they combat the cough and dyspnoea. In hæmoptysis they will often check hæmorrhage where other remedies fail. To avoid unpleasant after-effects, which are very rare in adults, heroin should be given always after meals. Heroin is also a very valuable drug in diseases of children, but the dose should be as small as possible. Heroin should be tried in whooping-cough, being of decided benefit in many cases, reducing the number of attacks, or at least influencing their duration and severity. Heroin and heroin hydrochloride, especially the latter, when used hypodermically, act promptly in bronchial asthma. I. J. Martinson (N. Y. Med. Times, Jan., 1901).

In corneal diseases dionin is very beneficial; ulcers heal rapidly and pain is prevented. It is best applied in combination with mydriatics. A 5- to 10-per-cent. solution may be used. Dionin acts

chiefly by increasing the flow of lymph. Ludwig Vernies (Klin-therap. Wochen., Feb. 10, 1901).

Heroin is considerably less poisonous than morphine or cocaine. It may be given with safety in doses of $\frac{1}{12}$ to $\frac{1}{8}$ grain. It quiets cough and increases the depth of respiration. It is particularly useful in tuberculosis of the larynx. Nusch (Münchener med. Wochen., Mar. 19, 1901).

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OPTIC NERVE AND RETINA, DISEASES OF THE.

The optic nerve and the retina, forming, together, an offshoot of the central nervous system, show the closest association in their diseases, which are largely dependent on general disease and disease of other organs. Being open to inspection and minute investigation, they furnish valuable diagnostic and prognostic indications regarding the conditions with which they are associated.

Retinitis.—Retinitis is an inflammation of low grade and extremely chronic. Heat and pain are absent, redness is often confined to doubtful changes in the retinal vessels, and swelling is evident chiefly through the opacity of the exudate.

Symptoms.—Impairment of vision is the only constant rational symptom; and it is not characteristic, and tells little of the cause or gravity of the disease. In the early stages it appears as a diffuse clouding of the field of vision or some part of it. Later it may be a distortion of objects (metamorphopsia) or an annoying quivering of the thing looked at. In some forms impairment of vision is greatest by a bright light: *day-blindness*. In others it is greater by feeble illumination: *night-blindness*. Flashes of light sometimes occur, but they may not be noticed at all. The

important symptoms are wholly ophthalmoscopical. They include opacity of the retina, alteration of the retinal vessels, hæmorrhage, and pigment deposits and alterations.

Opacity prevents the seeing of the retinal pigment-layer, and the color or details of the choroid, which are visible through the normal transparent retina. The opacity may appear as a gray veil, faintly blurring or entirely obscuring the deeper structures, or it may have the form of definite dirty-white or clear, glistening-white masses. Its effect on the retinal vessels varies with their depth in the retina. A vessel running on the surface of the retina is more distinctly seen than normal, because of the contrast furnished by the gray or white opacity of the retina behind it. But a portion of a retinal vessel imbedded in the retina will be partly or entirely hidden by the opacity.

The retinal vessels may be distended uniformly or irregularly. Distension renders the visible vessels larger, and more of the small vessels visible; and it also makes the vessels more tortuous. The tortuosity is shown both by the wavy outline in the plane of the retina and by more decided differences of level in different parts of the vessels; so that some parts stand out with greater distinctness, while others are comparatively buried in the depths of the retina. Irregular distension of the retinal veins occurs in retinitis, indicating disease of the retinal walls.

RETINAL HÆMORRHAGE is liable to occur in violent retinitis of any kind, causing dark-red spots in the fundus. When it takes place into the nerve-fibre layer, the blood becomes diffused in the direction of the bundles of fibres, forming what are known as "flame-shaped" patches, narrower toward the optic

nerve, wider and having a "feather-edge" in the opposite direction. In time the dark-red spot of hæmorrhage disappears. It may be followed by a patch of white or a marked disturbance of pigmentation.

SUBHYALOID HÆMORRHAGES.—These are large, rounded areas of hæmorrhage, located near the posterior pole of the eye and often shifting their positions from day to day, situated between the retina and vitreous. They undergo absorption, with sometimes full restoration of vision.

Patches of retinal inflammation are often followed by atrophy of the retinal pigment-layer or the formation of black pigment-blotches. But these only become visible when the inflammatory opacity and swelling has so far subsided as to permit a view of deeper structures.

Varieties.—SIMPLE or SEROUS, retinitis may be caused by eye-strain, choroidal inflammation, or obscure constitutional conditions. It may be limited to small isolated areas. The affected parts of the retina appear gray or bluish, with indefinite edges. It affects one or both eyes.

PURULENT RETINITIS results from injury, as a penetrating wound or the lodgment of a foreign body in the vitreous; or it may be a *septic, metastatic, or embolic* retinitis, arising in connection with pyæmia, puerperal fever, etc. It may present only small, white spots, and hæmorrhages scattered throughout the retina; or may be indistinguishable from purulent choroiditis, ending in panophthalmitis or in chronic purulent accumulation in the vitreous: *pseudoglioma*.

ALBUMINURIC RETINITIS commonly attends chronic, non-exudative, or interstitial, nephritis. (See BRIGHT'S DISEASE, volume i.) It arises when, after the period of high vascular tension, elimination is beginning to fail. It is not an early symptom, but it is often the

first symptom that leads to a correct diagnosis. It may occur with the albuminuria of pregnancy. It often presents a characteristic appearance, consisting of white dots, arranged somewhat in lines that radiate from the fovea. There are retinal hæmorrhages, usually "flame-shaped," and irregular dilatation of retinal veins. The optic nerve may be involved in the inflammation. There may also be extensive masses of retinal exudate. Both eyes are commonly affected. The appearance of this form of retinitis in chronic Bright's disease commonly indicates a fatal termination of the case within a year or two.

LEUKÆMIC RETINITIS occurs in leukaemia and pernicious anæmia. (See ANÆMIA, volume i.) The whole fundus may be obscured by the retinal swelling, and often has a markedly-yellowish color. Retinal hæmorrhages are numerous, and the retinal veins may be enormously dilated, while both arteries and veins are comparatively pale. Both eyes are affected.

HÆMORRHAGIC RETINITIS, or RETINAL APOPLEXY, is marked by hæmorrhages in all parts of the retina, which recur again and again. It depends on disease of the retinal vessels. Vision is greatly impaired, and hæmorrhagic glaucoma is likely to ensue. One eye is likely to be affected earlier, or to a much greater extent, than the other.

GOUTY RETINITIS occurs in elderly gouty persons. There are yellowish-white patches of exudation. The vessels are irregularly narrowed, with thickening of their walls. In the early stages there are hæmorrhages. Impairment of vision is progressive, but rarely goes on to complete blindness.

DIABETIC RETINITIS is characterized by ivory-white dots of exudation—most numerous near the posterior pole of the

eye, but not grouped in any special figure—and points or larger spots of hæmorrhage. (See DIABETES MELLITUS, volume ii.)

SYPHILITIC RETINITIS is one of the late secondary lesions. It is commonly attended with choroidal disease and dust-like opacity of the vitreous. The retinal exudate may be localized, especially at the macula or in a zone around the optic disk. Vision is always permanently impaired. The optic disk may be at first red and swelled, and later undergo atrophy, becoming yellowish in color, with narrowed retinal vessels.

PUNCTATE RETINITIS shows numerous white or yellowish-white points scattered throughout the fundus, with some impairment of vision. It is probably the permanent condition following some active disease.

CIRCINATE RETINITIS is characterized by a wreath of brilliant-white spots near the macula or the optic disk, or including both these regions. This appearance is preceded by retinal hæmorrhages. Vision is permanently impaired.

STRIATE RETINITIS.—In this form of retinitis yellow or gray lines or streaks appear in the retina. Sometimes they are straight, as if drawn upon, in other cases curved, but not conforming to any normal structure. They may follow detachment of the retina, if the detached portion resumes its normal position.

PROLIFERATING RETINITIS includes cases in which masses of opacity, probably following large hæmorrhages, extend from the retina into the vitreous humor.

RETINITIS FROM EXCESSIVE LIGHT occurs after looking at the sun without sufficient protection, as after watching an eclipse. A small central scotoma occurs, attended and followed by persist-

ent dazzling and metamorphopsia. After exposure to the arc electric light at a short distance the same trouble may develop; but it is at first attended with smarting, burning, and swelling of the conjunctiva, probably dependent on some other effect of the electrical discharge.

RETINITIS PIGMENTOSA is a condition of retinal degeneration, usually congenital. It is characterized by night-blindness, great narrowing of the visual field, the deposit of pigment-masses in the retina, narrowing of the retinal vessels, and atrophy of the optic nerve. The pigment-spots are branching, often the shape of bone-corpuscles. They appear first and are most numerous in the periphery of the fundus. The night-blindness is commonly noticed in early childhood, and the disease is slowly progressive until at the age of sixty most cases end in complete blindness. Sometimes a very similar condition, but running a more rapid course, occurs in tertiary syphilis. In a few cases, otherwise similar, no pigment-deposits occur.

AMAUROTIC FAMILY IDIOCY is attended with a white opacity of the retina about the macula, with a red spot in its centre, and blindness soon becoming complete, from degeneration of the nerve-cells of the retina.

ANGIOID STREAKS in the retina, brownish streaks of pigment-deposit which have the shape of a vascular network, but which do not conform to either the retinal or choroidal vessels, mark a special form of a retinal degeneration. Vision is impaired, and the streaks are preceded by retinal hæmorrhages.

Diagnosis.—Retinitis must not be confused with blurring of the retinal vessels and other details of the fundus due to errors of refraction, especially regular astigmatism. Blurring from an error of refraction affects all parts of the fundus,

or all parts of the retinal vessels running in a certain direction. Retinitis affects only certain portions of the fundus, or some parts more than others, and veils the vessels running in one direction no more than those running in another. The haziness caused by dust-like, localized opacities of the vitreous simulates that of retinitis. Patches of serous retinitis may closely resemble detachment of the retina. The appearance of the retinal vessels upon the surface, with prominence of the swelling and the involvement of a large area, indicates detachment.

Retinitis is generally followed by degenerative changes, and many of the symptoms characterizing its various forms are really degenerative. The diagnosis between the different varieties is indicated in their description. In determining the form of the retinitis other symptoms of the underlying general condition should also be sought for and carefully considered. Thus albuminuric retinitis may be exactly simulated by the retinal symptoms of organic disease of the brain; and only the renal or the cerebral symptoms can establish the diagnosis.

Prognosis.—This depends on the cause of the retinitis. Simple inflammation from eye-strain may end in complete recovery. Purulent retinitis commonly destroys the eyeball, but the form characterized by small, white spots may go on to incomplete recovery. Albuminuric and leukæmic retinitis may improve under treatment, but they partake of the grave prognosis of the underlying diseases. Albuminuric retinitis arising during pregnancy may undergo very marked improvement. Retinitis pigmentosa goes slowly on to hopeless blindness. Other forms of retinitis rarely cause complete blindness; but the vision once lost

through them is not regained, or is only partly recovered.

Treatment.—Rest for the eyes and avoidance of bright light and sudden changes of illumination are important, in the active stages of retinal inflammation. Rest must include the use of lenses correcting any ametropia, and may require the use of colored glasses or a cycloplegic. Removal of the cause or appropriate treatment of the underlying dyscrasia comes next in importance. After the acute stage has passed, the retinal degeneration succeeding it is best met by tonics, and especially strychnine in doses ascending to near the limit of physiological tolerance. Retinitis pigmentosa requires a very moderate use of the eyes and the tonic treatment throughout. Instillations of a weak solution of physostigmine may be employed; and the application of a weak galvanic current, $\frac{1}{4}$ to 1 milliampère, has been credited with benefit.

Embolic and Thrombotic of the Central Retinal Artery.—These cause sudden blindness of one eye, usually permanent.

SYMPTOMS AND DIAGNOSIS.—There is general haziness of the retina, most intense near the posterior pole of the eye, with a dark-red spot at the macula. When one or more branches of the central artery escape obstruction, a corresponding portion of the field of vision is retained. When the macula is supplied by a cilio-retinal artery, full central vision may be preserved. At first the retinal arteries retain their normal appearance, while the veins usually are narrowed or partially collapsed. Later both arteries and veins become greatly shrunk, and the optic disk white and atrophic. The two conditions are to be distinguished from one another chiefly by the presence of some probable source

for the embolus in embolism; or preceding symptoms of vascular disease, as brief obscurations of vision, for thrombosis.

PROGNOSIS AND TREATMENT.—In thrombosis the recovery of vision is very improbable. In a few cases of embolism some vision is recovered. Either spontaneously or under treatment the embolus may be broken up and pass onward into some branch of the artery, and even into such peripheral branches that its effects are no longer noticed. To favor such a termination the inhalation of nitrite of amyl may be pushed to a decided physiological action, and active massage of the eyeball employed. These should be repeated daily for several days before abandoning hope of improvement. If the embolus is dislodged, strychnine may be indicated to promote restoration of the retinal function.

Thrombosis of the central retinal vein causes blindness, less sudden and complete than that due to the obstruction of the artery. It is attended with dilatation of the retinal veins and hæmorrhages throughout the retina, and may be followed by hæmorrhagic glaucoma. The treatment is that of the general condition accompanied by the retinal disease.

Detachment of the retina is a displacement of the retina from its normal position. This may be caused by a tumor or by a displacement of the choroid. But the term is commonly understood to mean a separation of the retina from the choroid by serous fluid.

SYMPTOMS.—There is impairment of vision, usually sudden, and affecting but a portion of the visual field. Commonly the subretinal effusion settles to the lower part of the eye, so that the upper part of the field of vision is lost. The detached portion of the retina may float

in front of some part still normal, causing sudden temporary loss of vision. With the ophthalmoscope a gray veil is detected, hiding more or less completely the normal red of the eyeground. It presents rounded folds, which float, as the movements of the eye disturb the fluid beneath. These folds are more hyperopic or less myopic than the undetached parts of the retina that may be seen above them. On the folds may be traced the retinal vessels, appearing very small and dark in color.

DIAGNOSIS.—The rounded gray folds with the retinal vessels on them are unmistakable. It is sometimes more difficult to decide if the case is one of simple detachment or one of detachment due to new growth. Movement of the folds of retina, after moving the eye, indicates that it is floating freely on serous fluid. When attached to a choroidal growth no such movement occurs; and the vessels of the growth, resembling choroidal vessels, may be seen through the retina. When a new growth exists, but the retina is separated from it by serous fluid, the growth may be perceived through the retina by making the ophthalmoscopical examination with direct sunlight. The tension of the eyeball may throw some light on the case, being normal or below in simple detachment and sometimes elevated in cases of tumor. The recognition of detached retina accompanying cataract is important as influencing the prognosis regarding the results of operation. It must depend chiefly upon the careful testing of the field of vision.

ETIOLOGY.—Blows on the eye or head may cause detachment of the retina, either primarily or as the result of other changes in the eye. Very myopic eyes are especially liable to it, and the liability increases with age. Extensive

changes in the vitreous, especially cicatricial contraction, may pull the retina away from the choroid. Sometimes a tear may be recognized in the detached retina, apparently due to such traction. Through it the choroid may be clearly seen with the ophthalmoscope.

PROGNOSIS.—A small proportion of cases recover spontaneously. This most frequently occurs in traumatic cases. In a large proportion of cases no treatment will effect the permanent replacement of the retina and restore sight. There is no hope of cure for eyes having excessive myopia or great alterations of the vitreous.

TREATMENT.—An opening through the sclera permitting the subretinal fluid to escape externally, with or without an opening through the detached portion of the retina to allow it to pass freely into the vitreous, has usually caused a temporary improvement in the detachment; in a very few cases it has afforded permanent relief. But in most cases the detachment has recurred, and there has been no permanent benefit. The burning with the galvanocautery of one or two holes in the sclera that will close only after several days or weeks is claimed to be more efficient. The greatest chance of permanent restoration is given by prolonged rest in bed, with the eyes covered most of the time by a pressure bandage; and the use of pilocarpine-sweats and potassium iodide or salicylic acid internally. But this must be persisted in for several weeks to render the benefit permanent; and in a large proportion of cases it fails to do good.

Glioma of the Retina—or, more strictly, *gliosarcoma* of the retina—is a malignant new growth occurring in early childhood.

SYMPTOMS.—Attention is usually first

attracted by the appearance of a yellowish reflex in the somewhat dilated pupil, and the eye is found to be blind. On examination the reflex is found to be due to a growth situated back of the lens. It has a silvery or yellow, shining appearance, and small blood-vessels may be seen on it. As it increases the lens and iris are pushed forward, the tension of the eyeball becomes elevated (second, or glaucomatous, stage), and symptoms of irritation and inflammation appear. When the growth perforates the sclera (third stage) the tension falls, and for a few days the symptoms may seem to abate. Soon, however, the growth causes a noticeable tumor in the orbit, which increases more and more rapidly. Involvement of the brain through the optic nerve or of other organs (fourth stage) quickly occurs, and causes death. Sometimes the growth sets up an iridocyclitis that leads to diminished tension and shrinking of the eyeball (*cryptoglioma*), which, however, ends in the further extension of the tumor. In a large proportion of cases both eyes are affected.

DIAGNOSIS.—The only affection liable to be confused with typical glioma of the retina is chronic purulent accumulation in the vitreous, or *pseudoglioma*. This gives rise to a yellow reflex back of the lens, commonly exhibiting no vessels. Such an accumulation follows purulent retinitis or choroiditis, generally as a sequel to some acute febrile disease, as scarlet fever and cerebro-spinal meningitis. Glioma gives no history of antecedent disease. In *pseudoglioma* the tension of the eyeball is almost always diminished. In glioma it is normal or elevated. *Pseudoglioma* remains stationary; glioma is progressive. In *cryptoglioma* diagnosis may, for a time, be impossible. But, the eye being blind,

to treat it as the seat of glioma is proper in any doubtful case.

TREATMENT AND PROGNOSIS.—The treatment for glioma of the retina is removal of the eyeball at the earliest moment, with so much of the optic nerve as can be readily taken with it. If the growth has reached the third stage the removal of the whole contents of the orbit is necessary. Without complete extirpation of the tumor it always causes death. After early removal of the eye about one-third of the cases remain permanently free from the disease. But only the lapse of a sufficient period of time, at least three years, can give positive assurance that there will be no recurrence.

Optic neuritis, papillitis, or choked disk is an inflammation of the ocular end of the optic nerve. It is important as a symptom of the diseases which cause it, and on account of the atrophy and impairment of vision which are liable to follow it.

SYMPTOMS.—The essential symptoms, hyperæmia and swelling, are only discoverable by the ophthalmoscope. Hyperæmia at first causes the optic disk to appear redder, and more uniform in color than normal. At the same time exudation causes blurring or complete obscuration of its outlines; so that the location of the disk may only be recognized by the convergence to it of the larger retinal vessels. As the inflammation advances, the swelling becomes greater; and measurement of their refraction with the ophthalmoscope shows that the vessels at the centre of the disk are pushed forward into the vitreous. With the increased swelling the small vessels become separated by exudate, and the general color of the disk becomes more gray. The individual vessels, greatly enlarged and tortuous, appear

and disappear in the swelling. The principal branches of the retinal arteries are small from compression at the point of entrance to the eye; and from compression at the point of exit the veins are swelled, dark, and tortuous. Hæmorrhages occur mostly on or near the disk. Vision may not be noticeably impaired. It may remain practically normal, even with great swelling. When impairment of vision does occur, it is rather a sign of optic atrophy secondary to the neuritis, or of involvement of the visual centres or optic tract within the cranium. The course of the disease is essentially chronic, sometimes lasting for many months, or even several years, when caused by a slowly-growing tumor. Ultimately, if the patient lives long enough, the swelling becomes paler and diminishes, and the process passes over into one of optic atrophy. Commonly both eyes are affected, although often one earlier or more severely than the other.

Monocular neuritis may occur from cold, rheumatism, or local causes.

The diagnosis rests on the ophthalmoscopical appearances above described. In a severe case these cannot be mistaken. But a commencing neuritis may easily be confused with the hyperæmia and slight haziness of the disk, often seen with eye-strain, and in rare cases protrusion and haziness exist as a congenital anomaly. In these doubtful cases repeated observations must be made. At this stage neuritis is progressive, the swelling and the alterations of the vessels increasing, while conditions with which it might be confused remain unchanged for a long period. Subsiding neuritis, which might also be overlooked, is likely to be attended with impairment of vision, especially with irregular contraction of the field of vision; and with opacity of the nerve-head hiding its

deeper details, pigment-disturbances about the disk, and opacity of the walls of the retinal vessels or irregularities in their calibre.

ETIOLOGY AND PATHOLOGY.—A mild form of optic neuritis may arise from eye-strain. Syphilis, rheumatism, lead poisoning, Bright's disease, and extension of inflammation from adjoining structures may cause it. But the larger number of cases are due to organic disease of the brain and its membranes, especially tumor, meningitis, and abscess. Its connection with intracranial disease has been the subject for much speculation. The principal theories to account for it are: 1. That the inflammation reaches the nerve-head by direct extension from within the cranium, either through the nerve-trunk or along its sheath. 2. That the inflammation is due to "choking of the disk" by intracranial pressure, transmitted by the veins or the lymph-spaces around the nerve to its point of entrance into the eyeball, where the sheath of the nerve is usually found dilated. 3. That the inflammation of the nerve-head arises through a nerve-influence controlling its nutrition and originating in afferent nerves distributed to the cerebral meninges. 4. That toxic substances make their way along the lymph-spaces surrounding the optic nerve from the cranial cavity to the nerve-head, where they excite inflammation. Neither of these theories seems consistent with all the facts, and it is probable that various influences contribute to the result. Relief of intracranial pressure is often followed by improvement in the neuritis, and Deyl suggests that the pressure may act by "choking" the central retinal artery and vein where they enter the optic nerve back of the eye.

PROGNOSIS.—If the cause of the optic

neuritis is one that can be removed, partial or complete recovery is likely to follow. Otherwise the neuritis passes into the optic atrophy, and blindness results.

TREATMENT. — Besides the efficient treatment of its cause and especially the treatment for syphilis in all doubtful cases, the standard treatment for optic neuritis of intracranial origin is by potassium iodide in doses rapidly increased up to the limit of tolerance. Tapping the sheath of the optic nerve has been tried with the idea of relieving pressure, but it is of doubtful benefit.

Retrobulbar optic neuritis is marked by pain in the orbit and soreness or tenderness on moving the eye or pressing it backward. Vision is impaired in some part of the field of the affected eye. At first the disk may appear normal, or slightly swelled and hazy. Later it may show signs of atrophy. Recovery usually occurs, and vision may be completely restored. The causes are cold, rheumatism, syphilis, acute fevers, and alcoholic or other poisoning. (See **TOXIC AMBLYOPIA**.) It may attend degenerative disease of the brain and spinal cord. It is to be treated through its cause, and by local blood-letting, potassium iodide, and later strychnine.

Optic Atrophy. — Atrophy of the optic nerve consists essentially in atrophy of some or all of its nerve-fibres. It is always attended with impairment of vision, and is a common cause of permanent blindness. It is also important as a sign of disease in the central nervous system.

SYMPTOMS. — The impairment of vision generally affects central vision, and always includes some limitation of the visual field. It is at first progressive. The fields for colors are usually contracted earlier and to a greater extent

than the field for form; and they may be obliterated, producing acquired color-blindness. When the blindness is complete, especially if it has come on rapidly, the pupils may be widely dilated. More commonly the pupils are not greatly enlarged. With the ophthalmoscope the optic disk is found less vascular than normal. It may be a dead white, or gray, bluish, or greenish hue. It presents few small vessels. The large branches of the retinal vessels may be of normal size, or they may be greatly contracted.

CAUSES AND VARIETIES. — Atrophy, not due to preceding disease of the optic nerve or retina or to injury or to pressure on the nerve or chiasm, is called *primary atrophy*. It may be congenital or hereditary or may follow acute disease or syphilis. It sometimes accompanies or precedes spinal sclerosis, or is caused by poisoning by lead, alcohol, etc. Atrophy following injury to, or pressure upon, the optic nerve is called *secondary*. *Consecutive atrophy* is atrophy following optic neuritis or neuroretinitis, or disease of the retina or chorioid, as embolism of the central retinal artery or syphilitic chorioretinitis. Its causes are those of the conditions it follows.

DIAGNOSIS. — The ophthalmoscopic picture of advanced atrophy is usually quite striking. But commencing atrophy cannot be certainly recognized with the ophthalmoscope; and even the appearance of pronounced atrophy may be simulated in disease, like quinine blindness or ischæmia of the retina from severe hæmorrhage, which admits of partial or complete recovery. The diagnosis is most safely based on narrowing of the field of vision, particularly for colors, with ophthalmoscopic appearances that point toward atrophy.

In primary atrophy the disk is usually

gray and its details, with the lamina cribrosa, very distinct. The retinal vessels are not greatly narrowed. The field of vision is contracted regularly. In secondary atrophy the disk is more likely to be white. The retinal vessels may or may not be contracted. In consecutive atrophy the nerve-head is usually opaque, the neighboring choroid disturbed, and the retinal vessels somewhat contracted and often irregular in calibre. The visual field is irregularly contracted. After chorioretinal disease the disk shows dirty-yellowish color, and the lamina is hidden.

TREATMENT AND PROGNOSIS.—The most effective measures are those directed to the causes of the atrophy, and they must be as varied as those causes. In addition, mercury and potassium iodide may be tried in the early stages, even in cases not of syphilitic origin. Later strychnine should be tried in doses rising gradually to the physiological limit. This is sometimes as high as $\frac{1}{5}$ grain, three times daily by the mouth, or once daily hypodermically. General measures, including change of occupation and climate, may be beneficial. Inhalations of nitrite of amyl and applications of galvanic electricity have been tried with reported benefit in some cases. Primary atrophy generally goes on to blindness. The prognosis for secondary and consecutive atrophies depends on early treatment and the possibility of controlling the cause.

Tumors of the optic nerve cause protrusion of the eye and loss of sight. They begin in childhood and develop slowly, without pain or much interference with the movements of the eyeball. They are usually myxomas or fibromas which do not recur after removal.

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ORBIT, DISEASES OF.

Congenital Malformations.

ANOPHTHALMOS, or congenital absence of the eyeball, is a rare condition; and in most cases there is found on dissection a small button of tissue representing the globe, which is often attached to a thin-walled cyst that distends the lower lid. The lids and orbits are commonly smaller than normal.

MENINGOCELE—a protrusion of the brain-meninges into the orbit through a lack of development of the wall of the latter—is distinguished from other tumors of the part by presenting an elastic rounded swelling, which pulsates with the heart, and can be reduced by steady pressure until the defect in the orbital walls is revealed.

MICROPHTHALMOS, or congenital smallness of the eye, varies from cases that present only high hyperopia to those approaching anophthalmos. In the higher degrees the eyes are always quite defective. Both eyes are commonly affected.

ENOPHTHALMOS, or sinking of the eyeball within the orbit, is noticed after exhausting disease, in paralysis of the sympathetic nerve; neurotic facial atrophy, occurring periodically with neuralgia of the fifth nerve; and after traumatism. In the latter case it may be due to fracture of the walls of the orbit or to the influence of cicatricial bands.

EXOPHTHALMOS, or undue protrusion of the eyeball, may arise from many conditions. It is the most striking symptom of exophthalmic goitre (see volume iii), may be produced by emphysema of the orbit, after fracture of the bones including the air-passages. It is also caused by hæmorrhage into the orbit or inflammation, disease of the orbital walls, new growths, or by paralysis of the ocular muscles, especially those supplied

by the oculomotor nerve. Temporary exophthalmos may be produced by stooping, and holding the head low, especially in women near the menopause.

PULSATING EXOPHTHALMOS, attended with a distinct bruit heard over the temple and neighboring parts and audible to the patient, is most frequently caused by a rupture of the carotid artery into the cavernous sinus. This may occur spontaneously or from crushing injuries to the head. Pulsating exophthalmos has sometimes ended in spontaneous recovery. In other cases no lesion was revealed by post-mortem dissection. In a few cases it has been due to aneurism of the ophthalmic artery.

Treatment.—Pressure on the carotids, either intermittent, which may be made by the patient himself, or continuous, should be tried. When pressure fails, ligation of one, and often the second, carotid should be resorted to.

A traumatic sacculated aneurism of the internal carotid in the cavernous sinus may give rise to the typical symptoms of pulsating exophthalmos. This lesion can follow a head injury without being directly caused by basal fracture. There is no evidence to prove that this condition does not always occur at first, and a communication with the veins is a latter and secondary consequence. The signs of pulsating exophthalmos are not necessarily due to the presence of arterial blood in the ophthalmic veins, and need not be dependent on excessive dilatation of those veins. In young subjects and in traumatic cases seen early, ligation of the common carotid is the best treatment. H. L. Barnard and H. M. Rugby (*Annals of Surgery*, May, 1904).

Orbital Cellulitis.

General inflammation of the extra-ocular contents of the orbit arises from traumatism, cold, erysipelas, other specific fevers, metastasis in septicæmia, thrombosis of the cavernous sinus, or ex-

tension of inflammation from the eyeball, or from the walls of the orbit, or the neighboring cavities.

Symptoms.—There is pain in the orbit, and often severe general headache, lessened mobility of the eyeball, protrusion of the eye, and swelling of the orbital tissues and lids. The vision is impaired and diplopia may be noticed. The invasion may be marked by a severe chill, and considerable fever may attend the disease. The eyeball is liable to become involved in the inflammation; and, even if this does not occur, optic neuritis and atrophy are apt to result. There is serious danger of extension to the meninges of the brain, causing death. In a few cases the symptoms are mild and spontaneous recovery occurs in a few days.

Case in which, as a result of the orbital infection from chronic suppuration of the ethmoid cells, the eye became proptosed, the conjunctiva and lids œdematous. The general condition was very serious. Temperature, 103.8°. Under an anæsthetic the surgeons explored the orbit and found the os planum carious, a large abscess cavity near the roof of the orbit. Frontal sinus, however, not infected. Four days later, since the patient had not improved, but rather lost ground, the brain was exposed. A large abscess was found in the frontal lobe. Though the immediate improvement was great it was not permanent, and the patient died five days later. Gruening (*Medical Record*, Feb. 6, 1904).

Treatment.—On the appearance of the earliest symptoms free local bleeding by leeching, or the artificial leech, should be resorted to, and calomel given and followed by a saline purgative. Hot fomentations should be applied, and frequently renewed to keep them as hot as can be borne. Any localized accumulation of pus should be promptly and freely evacuated. Even when no pus

has accumulated, it is well to make incisions with a straight bistoury, from the retrotarsal folds of the conjunctiva, parallel with the orbital walls and as near them as possible, to the depth of an inch or more. These incisions may be washed out with warm, antiseptic solutions and packed with antiseptic gauze. When swelling of the lids prevents the making of such incisions from the conjunctival sac, they may be made through the lids, near the orbital margin. In any case they should be so placed as to avoid injury to the ocular muscles if possible. If the eyeball has been the starting-point of the orbital inflammation, and is so damaged as to preclude vision, it should be promptly enucleated. The general treatment should often include tincture of iron, quinine, and good feeding, and sometimes alcoholic stimulants.

For cellulitis, the skin of the orbit should be repeatedly painted with a 5-per-cent. solution of silver nitrate, and a boric-acid dressing and roller pressure-bandage applied. Godfrey (Med. Rec., Nov. 3, '94).

TENONITIS, or inflammation of the oculo-orbital fascia, presents many of the symptoms of orbital cellulitis, but in less severe form. The immobility of the eye and pain on movement are relatively great, but the swelling is less general and severe. It arises from traumatism, as from a squint operation, or is often of a rheumatic or gouty character.

Treatment includes hot applications, and free exit for any pus that may be formed. Sometimes local bleeding is important. The rheumatic and gouty cases yield to salicylates or iodides; pain may require the use of anodynes.

Orbital Tumors.

These cause displacement of the eyeball, dependent on the location and the size of the tumor. Sometimes there is

limitation of the movements of the eyeball or double vision. But with slowly growing tumors there may be great displacement of the eyeball, without diplopia or destruction of vision. Pain usually appears late in the progress of the growth.

Varieties.—TUMORS OF THE OPTIC NERVE cause early blindness and optic atrophy; the displacement is usually directly forward or a little outward, and ocular movements remain good. They are apt to have the character of a fibroma or myxoma, showing little or no tendency to recur.

DERMOID CYST.—This variety of growth appears as a rounded, slowly growing tumor, which is seen most frequently at the upper inner angle of the orbit; but it may be situated at the outer angle or the upper or lower margin.

CYSTICERCUS and **ECHINOCOCCIC CYSTS** also occur in the orbit, but are extremely rare in this country.

In a search through literature only 59 cases of echinococcus of the orbit found since 1774. In Fuchs's clinic in Vienna out of 142,425 cases of diseases of the eye but 2 cases have occurred during eight years. Albert Blaschek (Wiener klin. Woch., Feb. 9, '99).

ANGIOMATA, both simple and cavernous, occur in the orbit. They are compressible and commonly involve the lids. They increase in size with crying, or on holding the head down. They rarely exhibit pulsation; and the pulsation is never so marked as in meningocele or pulsating exophthalmos.

SARCOMATA.—These are the important malignant tumors of the orbit. They may be so vascular as to pulsate and be compressible; or they may be hard and fibrous, growing very slowly, and causing great displacement of the eyeball, without entire destruction of vision.

CARCINOMA of the orbit is always secondary to similar disease of the lacrymal gland, lids, conjunctiva, eyeball, or adjoining cavities or more distant organs.

Treatment.—Non-malignant tumors should be excised. In rare cases a dermoid cyst may extend so deeply that its complete removal by dissection would be extremely difficult or impossible. In such a case we should cleanse the remaining portion of the sac, and place in it tincture of iodine or crystals of silver nitrate to secure its obliteration. Where



Fig. 1.—Tumor of the orbit. (Vance.)

possible, benign tumors, even those of the optic nerve, should be removed without sacrificing the eyeball.

For malignant tumors the only hope for cure is by complete removal. In rare cases, where the eye retains useful sight, removal of the evident new growth must be depended on. But the prospect of future immunity is decidedly improved by the removal of the whole contents of the orbit. Sarcomas of the spindle-cell variety may not return. Other varieties are more likely to recur, and it is doubtful if removal often prolongs life. It

is, however, fully justified for the purpose of relieving pain and rendering the patient's condition temporarily more bearable.

Following conclusions are based upon histories of 36 cases of orbital tumors, all taken from personal private practice. All these cases have been watched from start to finish. In a much larger experience, extending over a period of twenty-five years of hospital service, the same conclusions have been reached:—

1. The prognosis of all forms of malignant orbital tumors, whether primary or secondary, is unfavorable; and, if the tumor is primarily in one or more of the deep facial bones or their sinuses, the prognosis is positively bad.

2. Except in the case of capsulated tumors of the orbit, surgical interference is almost invariably followed by a return of the tumor; and the growth of the secondary tumor is more rapid than that of the primary lesion. With each succeeding operation the period of quiescence in the return of the tumor grows shorter and the rapidity of the growth increases.

3. The patient's family, and in certain cases the patient himself, should, in the beginning, be told of the serious nature of the trouble, and be warned that complete removal of all disease-germs is a well-nigh hopeless task. The burden of the decision as to surgical interference must rest upon the shoulders of the patient.

4. Repeated operations in these cases undoubtedly shorten the life of the patient. While it is, therefore, our duty to operate in all cases in order to relieve severe or unbearable pain, we should be slow to operate merely for the sake of relieving temporarily physical disfigurement or deformity, especially if we are convinced that by so doing we shorten the life of the patient, even if that shortened life is rendered more bearable to him. C. S. Bull (N. Y. Med. Jour., Aug. 29, '96).

Operative procedure which possesses distinct advantages over Krönlein's original method. About the edge of the hair, in the pre-auricular and temporal

region, a vertical cut is made, five centimetres from the external border of the orbit, and four to five centimetres in length. From the upper end of this a horizontal incision is carried toward the upper outer angle of the orbit, and curving slightly upward in the direction of the eyebrow in which it terminates. Another incision parallel to this follows exactly the zygomatic arch and ends at the lower outer angle of the orbit. The skin included between these three in-

Case of sarcoma of the orbit which was cured after treatment by the x-rays. The patient had suffered from the tumor for about six weeks. There was marked proptosis, much swelling of the lid, and some pain. The growth was found to be attached to the orbital wall, and its nature was diagnosed as sarcomatous. This was confirmed by histological examination. Since the case seemed inoperable, it seemed right to try the x-rays as a last resort; the ex-

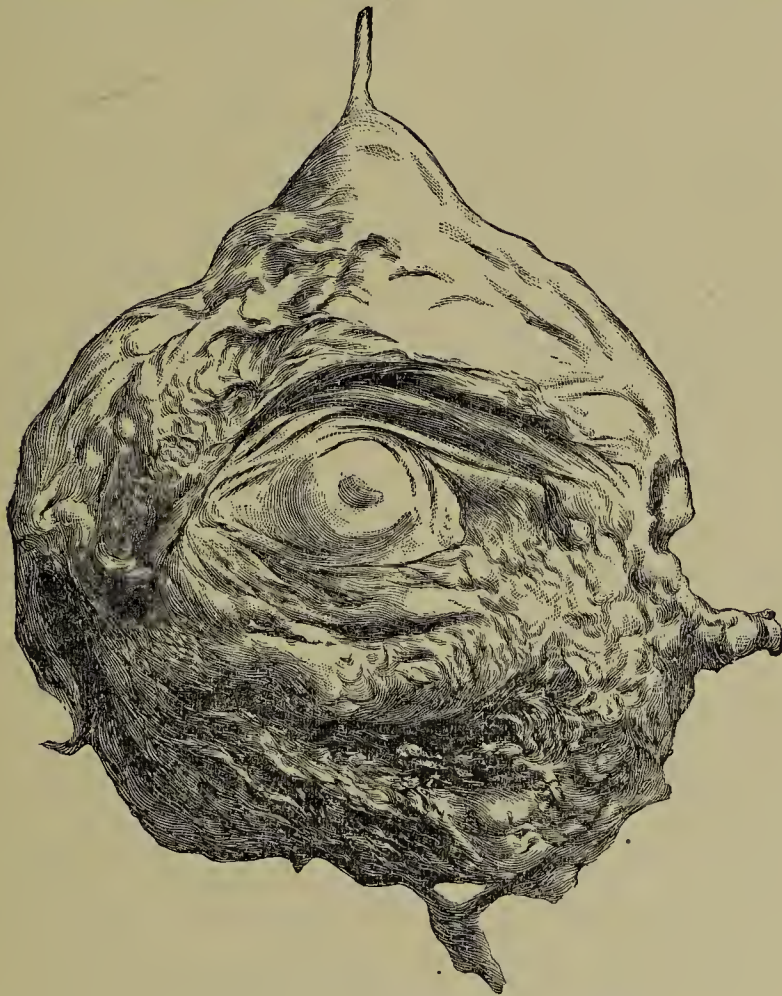


Fig. 2.—Tumor of the orbit. (Vance.)

cisions is dissected up, exposing the temporal aponeurosis and the upper edge of the zygoma. All bleeding is arrested, and the remainder of the operation follows precisely the directions given by Krönlein.

The incisions give the surgeon much more room during the operation; they are far enough from the conjunctival sac to exclude any risk of infection from it; and the cicatrices are scarcely noticeable, being largely hidden by the hair. Parinaud and Roche (*Annales d'Oculist.*, Oct., 1901).

posure was made at first every day for about five minutes, but after four weeks it was found advisable to reduce the number of sittings. The growth began to diminish, and at the end of six months had disappeared. Webster Fox (*Archives of Ophthal.*, Jan., 1904).

Miscellaneous Orbital Diseases.

Diseases originating in the orbital walls and neighboring cavities include a large proportion of the cases of orbital disease. The majority of malignant tumors grow into the orbit from adjoin-

ing cavities. Mucocoele and empyema of the frontal, ethmoidal, or maxillary sinus makes its way into the orbit, sometimes through an opening caused by absorption of the bony wall, sometimes pushing a bony shell before it. The most important treatment is that directed against the original disease. This, with free drainage, will generally secure the healing of the lesions in the orbit.

PERIOSTITIS AND CARIES OF THE ORBITAL WALLS cause orbital swellings, inflammation, abscess, and discharging sinuses. They must be treated as such lesions elsewhere, with especial care to keep up free drainage, and not to attempt the removal of dead bone, except after very careful study of the case, and through a free opening.

OSTEOMA OF THE ORBIT, or ivory exostosis, is a very hard, bony tumor, invading the orbit from the frontal or ethmoidal sinus, and sometimes also invading the cranial cavity. It appears at the upper inner angle, or the upper margin of the orbit, and grows very slowly, displacing the eyeball downward and usually outward, and for a long time continues painless. It should be removed as early as possible to forestall the danger of extension inward. There is little tendency to recurrence.

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ORTHOFORM.—Orthoform is the methyl-ester of meta-amido-para-oxybenzoic acid. It occurs as a white, or light, dirty-yellow, odorless powder, slightly soluble in water, and easily dissolved in glycerin or in water acidulated with hydrochloric, nitric, or acetic acid. It is feebly antiseptic, and has no poisonous properties. When applied to mucous or abraded surfaces, it exerts an

anæsthetic and analgesic action, which generally lasts at least twenty-four hours.

Preparations and Doses.—E. S. Yonge (Brit. Med. Jour., Feb. 5, '98) gives the following as being the most suitable preparations:—

1. The crude powder, either alone or mixed with equal parts of lycopodium, which should be accurately insufflated upon the required area, since orthoform takes effect only on contact and does not extend beyond.

2. Pastilles: Orthoform, 3 to 5 grains; solution of cochineal, q. s.; saccharin, $\frac{1}{4}$ grain; glyco-gelatin, q. s. These pastilles are useful in oral, tonsillar, and post-pharyngeal affections, but less so than the two preceding preparations.

3. Orthoform-collodion: A saturated solution of orthoform in collodion, forming a species of "varnish." This is useful in ulcers exposed to much friction; but, as it causes acute smarting, it is advisable to anæsthetize the ulcer first, either with cocaine or with orthoform in powder.

4. Spray: Orthoform, 5 grains; alcohol, 50 minims; water, 50 minims. This is used in spray and is, perhaps, the best form for treating nasal and laryngeal ulcerations. The alcohol evaporates quickly after contact with the parts, leaving the precipitated powder evenly distributed over the affected area.

5. Ointment (10 per cent.).

6. Aqueous solution (10 per cent.) of the hydrochloride as a paint.

Physiological Action.—Orthoform is said by Kallenberger to be absolutely free from any toxic property, and consequently may be used with perfect freedom. When it comes in contact with sensory nerve-filaments it has a powerful anæsthetic effect, which persists in some instances for three or four days;

on account of this property it is an excellent dressing for burns or painful ulcers. Another important property is its inhibiting effect upon secretion, and in case of carcinomatous ulcers or of transplantation-wounds the dressings remain so dry that they seldom require renewal.

Recent experiments by Soulier and Guimard, however, showed that in the dog a dose, by mouth, of orthoform which exceeds fifteen grains per 2 pounds of body-weight is to be considered toxic. But warm, 1-per-cent. solutions of orthoform, injected into the peritoneal cavity, produce toxic effects in the dose of $3\frac{3}{4}$ grains per 2 pounds of weight. The substance may, indeed, cause death in six minutes if it reach the dose of $7\frac{1}{2}$ grains per 2 pounds.

The action of orthoform, after injection, is that of a powerful cerebro-spinal nerve-depressant. Its local action, on the other hand, requires direct contact with the nerve-endings. Soulier and Guimard consider that orthoform is an *analgesic*, in the true sense of the word, rather than an anæsthetic.

Peculiar necrotic process noted appearing in the course of three to fourteen days after the application of orthoform to tumors, ulcerations, wounds, etc., and retrogressing when the orthoform was stopped. The first inflammatory stage of the process produced metastases in six cases, by reflex action or by the circulation, terminating in the necrotic stage. In the nine cases reported orthoform at first produced its usual favorable effect. In numerous other cases in which it was used both internally and externally there were no unpleasant results from its use. W. Asam (Münch. med. Woch., Feb. 21, '99).

Orthoform sometimes produces a decided irritating effect on the skin. When used in solution it excites hyperæmia, and sometimes severe pruritus. When used in the form of an ointment it not infrequently caused, in the course of one or two days, a pruritic eruption.

In one patient application of an ointment (1 to 40) to the face induced great swelling and marked redness, lasting nearly three weeks. In another patient use of the powder on a fissure of the vulva caused intense tumefaction, and nodular swellings in various parts of the body. Brocq (La Presse Méd., Apr., '99).

Orthoform may produce two separate varieties of eruption: erythema, alone or complicated with vesicles or pustules, and gangrenous eruptions, which are rare. The former may appear even when the orthoform is applied upon healthy skin, not necessarily upon an open wound. They are readily cured in a few days. The gangrenous eruptions occur when varicose ulcers are treated with orthoform. There is much pain. Two such cases reported, both of which recovered after a long time. The fact that the physician would not stop using the orthoform increased the period of duration of the gangrenous eruption. W. Dubreuilh (Phila. Med. Jour., from La Presse Méd., May 18, 1901).

Therapeutics. — Orthoform is chiefly used in painful ulcerations of the upper air-passages. It occasionally produces a slight burning for a few minutes after its application. It may replace cocaine when prolonged anæsthesia of ulcerated surfaces is desired, cocaine being reserved to produce temporary anæsthesia of an intact mucous membrane.

Orthoform has been extensively employed by Neumeyer (1) in painful disorders occurring in the upper air-passages, as in tuberculous ulceration of the larynx; (2) in operations as a local anæsthetic; (3) in pain due to gastric ulceration, whether simple or malignant; (4) in urethral pain; (5) in painful disorders of the skin; and (6) in neuralgias, in tabes, etc. He also observed that orthoform exercises an excellent local, anæsthetic action. One application often sufficed to lull pain for hours or even days. The remedy must be applied directly to the nerve-endings. In painful

angina of the throat the application of orthoform was without effect, as it does not act on an intact mucous membrane. In neuralgias it was without action.

Orthoform has given good results in hay fever, the powder being insufflated into the nasal cavities. Lichtwitz (*Archives Inter. de Laryng.*, Jan., Feb., '98).

Orthoform used in a large number of cases of rhino-laryngology, and complete local anæsthesia has always been obtained when applied to exposed sensitive terminal nerve-endings. In all forms and varieties of ulcerations in the nose, mouth, pharynx, or larynx it gives absolute freedom from pain, the effect lasting several hours to several days. It is so thoroughly antiseptic that ulcerations heal much more rapidly when orthoform is used than when it is not used. In troubles of the fauces where there is no ulceration, but where the epithelial layer of mucous membrane has been denuded, the application of orthoform relieves the pain and reduces the inflammation. After removal of the faucial tonsils, if orthoform is applied to the cut surfaces the patients can eat solid food without pain, and the parts heal quickly. There is no pain after removal of an elongated uvula if orthoform is applied.

In case in which a necrosed tooth was removed the soft parts were badly lacerated. The cavity was packed with orthoform and in a short time all pain was relieved and the patient could eat with no inconvenience. The relief of the pain lasted eight hours, when the cavity was again packed with orthoform. Twenty-four hours after the operation the case was examined and no pain, soreness, or inflammation was found; the lacerated parts were pale and shrunken, and did not become inflamed in the least. John North (*Amer. Med. Compend*, Nov., '98).

Emulsion of orthoform, 25 parts, and olive-oil, 100 parts, used for laryngeal application. The burning sensation lasts only about a quarter of an hour, and is then succeeded by anæsthesia, which commonly lasts from 24 hours to 3½ days. The patient is able to eat all kinds of food, the appetite is greatly increased, and it seldom causes dyspepsia.

The emulsion has been employed chiefly in cases of tuberculosis. A distinct diminution in the amount of secretion in cases of ulceration is noted, but otherwise it does not appear to have any local therapeutic value. Patients do not dread the lactic-acid treatment if orthoform emulsion is used regularly. Kassel (*Ther. Monats.*, No. 10, '98).

Orthoform may be employed in various combinations, at first as a powder without any addition; but the following emulsion with the yolk of an egg is particularly recommended:—

R. Menthol, 2½ drachms.

Ol. amygdal. dulc., 7½ drachms.

Vitelli ovi (about two yolks), 7½ drachms.

Orthoform, 3 drachms.

Aq. dest., q. s. ad 3 ounces.

M. Ft. emulsio.

The best results have been obtained with it, an ordinary laryngeal syringe being employed. In about five minutes the patient experiences a feeling of euphoria. The yolk of egg does not decompose, but remains permanent for a number of weeks. W. Freudenthal (*Phila. Med. Jour.*, Mar. 25, '99).

Orthoform used successfully for the purpose of making an arsenical paste painless when applied as an escharotic in removing various kinds of growths. W. R. Nicolson (*Atlanta Jour.-Record*, i, p. 738, 1900).

Orthoform is used as an application to burns and painful sores, applied in powder or ointment.

Orthoform induces anæsthesia of only those parts with which it comes in contact, and has no effect when applied to the unbroken skin. In a burn of the third degree the anæsthetic effect is remarkable. It also allays the pain of ulcers, both cancerous and other kinds. In one case as much as 750 grains were sprinkled on a wound within a week. It is strongly disinfectant, hindering decomposition and fermentation. Einhorn and Heinz (*Münch. med. Woch.*, Aug. 24, '97).

Observations made at the Munich Surgical Clinic on wounds of various kinds, on burns of second and third de-

grees, on ulcers (luetic, varicose, carcinomatous, etc.), on dental caries, etc., summarized as follows: 1. Loss of sensation commences, on the average, in from three to five minutes after application, whether as a powder or as 10- or 20-per-cent. ointment. 2. The anæsthetic action continues, on the average, for about thirty hours, in many cases even for three or four days. Only in one case did the action last scarcely two hours, the powder being carried away by copious secretion. 3. Diminution of secretion is always observed: a feature which is very valuable, for instance, in transplantations, where the grafting of the transplanted skin is promoted. The reduction of very copious and troublesome salivation in a case of inoperable cancer of the cheek was also noted. 4. Non-poisonousness is demonstrated by the fact that in a case of carcinoma 2 ounces weekly were applied without any bad effect. W. Cheatham (*Amer. Pract. and News*, Aug. 15, '98).

Forty cases of cracked nipples at the Charité Hospital were dressed with orthoform, which brought about complete anæsthesia during suckling and kept the cracks aseptic. The infant was put to the breast a quarter of an hour afterward, and sucked eagerly, as orthoform has neither taste nor smell. The anæsthesia persists for some time. Strong alcoholic solution of orthoform dropped into the cracks is better than the orthoform powder alone. Maygrier and R. Blondel (*Lancet*, Nov. 19, '98).

Orthoform is the sovereign agent for the pains occurring after the extraction of teeth with peridentitis. It may be applied on a moist piece of cotton, when it quiets at once the severest pain. Jessen (*Deut. Zaltaerztl. Woch.*, No. 10, '98).

Every operation about the rectum, about the urethra, and sexual organs is followed by the most intolerable pain, smarting, burning, or itching. All of these cases are relieved by the use of orthoform as a powder in the first dressing, its action lasting about twelve to twenty-four hours. Orthoform after operations for the removal of hæmorrhoids has been used with the most satisfactory results.

In burns of the hand most excellent results are obtained. If the blebs are large, they may be carefully dissected away with the scissors, and then dusted with orthoform powder. This is covered with plain gauze and surrounded with a liberal dressing of absorbent cotton. Bayard Holmes (*Woman's Med. Jour.*, Jan., '99).

Orthoform may be applied without danger to ulcerations of the mouth, pharynx, and larynx. It is also particularly useful as an analgesic in dysphagia due to cancerous ulceration of the epiglottis or œsophagus. Two and a half grains in cachet will ease the pharyngeal pains of gastric ulcer in five minutes. Manquat (*Archives Gén. de Méd.*, Apr., 1900).

LOCAL ANÆSTHESIA. — Hirschbruck, to obtain local anæsthesia, injects a 2-per-cent. solution of cocaine ($\frac{1}{30}$ grain of the salt) and then injects 15 minims of distilled water containing 3 per cent. of orthoform ($\frac{1}{2}$ grain) in suspension, the syringe being constantly shaken when administering the latter. This process appears to be quite free from danger. Anæsthesia is induced in from five to ten minutes.

By mixing 5 to 10 per cent. of orthoform with a 10-per-cent. solution of salicylate of mercury, the pain accompanying intramuscular injections for syphilis is prevented or relieved. There is some local pain with nausea eight to ten hours afterward, but these troubles are never intense and last only a short time. No unpleasant effects were ever observed. Loeb (*Monats. f. prak. Derm.*, B. 27, No. 1).

Employment of orthoform combined with Schleich's method in following manner: An injection is first made after Schleich's method, which permits the painless incision of the tissues. The anæsthesia is then completed and rendered more profound and durable by powdering the wound with orthoform. This method has given very satisfactory results. Isidor Dreyfus (*Münch. med. Woch.*, p. 527, '98).

As orthoform and new orthoform cannot be used hypodermically on account

of the difficulty with which they dissolve, and as their salts are too irritant for that purpose, there has been personally produced, by substitution, a substance sold under the name of nirvanin, which is not alone more permanent than cocaine, but also ten times less toxic; it is also antiseptic. In 2-per-cent. solutions, injected hypodermically, it produces a prolonged regional anæsthesia. Einhorn and Heinz (Münch. med. Woch., Dec. 6, '98).

In ninety-four operations performed under the effect of nirvanin. No unpleasant symptoms appeared in any of the cases. The best method of employing the drug is to make a 2-per-cent. solution with sterilized saline fluid. Teuchenburger (Münch. med. Woch., Dec. 6, '98).

Practically painless injections of calomel may be made by means of the simultaneous use of orthoform. The mixture was employed in a case of syphilitic glossitis, and, not only was analgesia obtained at the time of the injections, but on the fourth day, when there is usually a painful reaction, only slight local discomfort was evidenced. Danlos (Med. News, Mar. 4, '99).

In carious teeth with exposed nerve-endings a piece of cotton dipped into a saturated solution of orthoform and alcohol, packed not too tightly, will arrest the toothache in three or four minutes, and will hold its anæsthetic effect for several days if packing is not removed. Sprague (Amer. Therapist, Sept., 1900).

Orthoform may be taken internally in doses of 8 to 15 grains, as an internal anodyne.

Observations made in Leyden's clinic show that, besides its anæsthetic effect on raw surfaces, orthoform is absorbed by the intestinal canal, and is eliminated somewhat changed in chemical composition by the kidneys. It may be given in doses of from 15 to 20 grains per day, and it is said to relieve pain in cystitis and gonorrhœa. The urine does not readily undergo putrefaction during its administration. Editorial (Deut. med. Woch., June 30, '98).

In affections of the stomach about 3

knifepointfuls of orthoform should be given in a glass of water. This is to be taken at a draught and the patient should then lie in various positions successively, to insure contact of the mixture with the gastric wall at all points, unless any particular portion of the wall is the seat of pain, in which case the patient should lie in such a position as to bring about the prolonged application of the drug to the affected area. In ulcer of the stomach and in carcinoma (at the stage of ulceration) the analgesic effect was well marked. It is best administered on an empty stomach, and is especially efficacious after the organ has been washed out. Kindler (Fortschritte der Med., No. 7, '99).

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ORTHOPÆDIC SURGERY.

Definition.—Orthopædics is that branch of surgery which relates to the prevention and correction of deformities. Although it is difficult to draw a sharp line between cases that enter into the field of orthopædic surgery and those that do not, it is generally conceded that true orthopædic cases are those which require some mechanical appliances in their treatment.

Club-foot.

General Considerations and Varieties.

—Club-foot is the name applied to a condition of the foot in which it is more or less deformed and displaced from its normal position. The displacement of the foot is in the direction of a normal movement; thus, it may be inward, when it is called *pes varus*; outward, when it is called *pes valgus*; flexed anteriorly, constituting *pes calcaneus*; and extended, causing walking on the toes, when it is called *pes equinus*. The distortion may be a compound instead of a simple one, producing an *equino-varus* or *equino-valgus*. Usually the affection is congenital, but not rarely it is ac-

quired; in such cases paralysis plays an important part.

The most common form is equino-varus, in which the foot is raised at the

heel and the sole turned inward. Ordinarily the diagnosis is easy, but a wrong



Equinus.



Calcaneus.



Varus.



Valgus.

Varieties of simple club-foot. (*McCurdy.*)



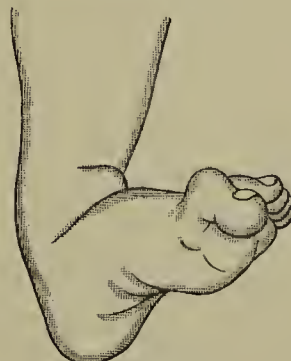
Equino-varus.



Equino-valgus.



Calcaneo-varus.



Calcaneo-valgus.

Varieties of compound club-foot. (*McCurdy.*)

course is not infrequently pursued, hardly on account of the difficulty in recognizing the condition, but rather because the parents and even occasionally the physician do not appreciate the necessity of instituting treatment at once. In congenital cases treatment can be carried on with advantage almost from the moment of birth, yet it is not seldom that the importance of undertaking treatment is only appreciated when the child attempts to walk, eight months to a year and even later. The difference between the acquired and congenital forms should be carefully established, as it influences both prognosis and treatment. In the congenital form, for instance, the muscles of the lengthened tendons are not paralyzed, but merely disabled by their abnormal position. When, therefore, the faulty position is corrected, the muscles will resume their functions, and the prognosis as regards an ultimate good result, and even complete cure, is excellent.

Again, in the acquired form paralysis of one set of muscles is usually more or less complete, and as this is often permanent it is obvious that in many cases a cure cannot be expected, and the best that can be done is to improve the function and appearance of the part. Operative measures are to be undertaken only with the greatest care. It is evident that if tenotomy is performed on the contracted muscles the limb is left helpless, as both sets of muscles are disabled.

1. The prognosis in ordinary non-paralytic club-foot is good.

2. In children the restoration of form should be perfect, and function should closely approximate the normal.

3. Restrictive methods, either by dressings or apparatus, should be as little employed as possible.

4. Persistent manipulation improves function and development.

5. Operative treatment must be thorough. No part of the correction of deformity should be left, hoping that mechanical means will complete the work.

6. Intelligent and long-continued after-treatment is essential to a final good result. Properly-constructed boots should be worn, and the foot retained in the corrected position at night.

7. Age is no bar to successful treatment. Eminently satisfactory results may be obtained in adult life. Even in the case of adults the more heroic methods of operation in many cases are not called for.

8. The prognosis in paralytic cases will vary according to the nature and degree of paralysis. McKenzie (*Canada Jour. of Med. and Surg.*, May, '99).

Experience based upon sixteen hundred and fifty operations suggests that all cases should be operated on after the fourth month where there is shortened skin and ligaments, and the open incision should always be employed. Prolonged medical treatment extending over months and years, while it may effect improvement, yet it only displaces the simplest and most certain way of dealing with these cases. An operation for club-foot should never be considered finished until the foot is placed in an overcorrected position with the foot flexed upon the leg and the heel prominent, so that it first strikes the ground in walking. Club-foot shoes of all kinds discarded and replaced by plaster of Paris or adhesive plaster to maintain the foot in an overcorrected position. Post-operative treatment is very important; indeed, the treatment of these cases may be said to just begin with the operation. Osteoclasis should be performed in all cases where there is an inward twist of the tibia; otherwise they will relapse. Bone operations should never be done prematurely. Open incision should supplement all cases of subcutaneous tenotomy when it fails to overcorrect. Short tendons and ligaments should be cut, and not stretched, as the latter deforms the foot. A case cannot be said to be cured and free from danger of relapse until the heel strikes

the ground first in walking. A. M. Phelps (Amer. Medicine, Apr. 6 and 13, 1901).

Astragalectomy is an operation that would never be required if the family practitioner could be brought to the comprehension that the treatment of club-foot should be commenced before the infant is twenty-four hours old,—almost, as has been remarked by one observer “during the third stage of labor.” It seems strange that any educated physician can willfully neglect the golden opportunity of molding such distorted bones during the first three months of life when the osseous structures are soft and when growth is so rapid that, if neglected, irreparable deformity of the bony structures must result. During these months constant manipulation and simple forms of retentive apparatus will accomplish wonders. De Forest Willard (“International Clinics,” vol. iii, Twelfth Series, 1902).

Pes Equino-varus.—In simple varus the foot is turned inward. The cases, however, usually have the heel more or less drawn up, and the affection is then designated equino-varus. The affection is usually congenital, both sides being generally affected. The acquired form results from disease of the bones or else paralysis—sometimes cerebral, but oftener spinal. In the congenital form treatment should be instituted as soon as the affection is discovered. The worst cases met with are neglected cases or those in which treatment has been inefficient. It is natural for the feet of an infant to turn inward rather than outward; therefore an outward deformity is more apt to attract attention than is the affection we are now considering. The fact that the feet are turned in a little more than is usual or that they are kept more persistently inward than they ought is a circumstance apt to be overlooked. The child does not attempt walking for several months and therefore careless parents allow the deformity to continue

until it interferes with the child's efforts to walk. The infant's foot is largely cartilaginous, and on that account is more readily molded into proper form than when the child is older. It is on this account that treatment should be commenced as soon after birth as possible. This softness of the infant's foot also prohibits the use of severe measures; its shapelessness also renders it impossible to apply apparatus in the form of shoes, and even other appliances are only retained for any length of time with difficulty.

Talipes equino-varus is always an avoidable condition, and the relapses are generally due to carelessness on the part of patients and friends and sometimes on the part of the practitioner. Robert Jones (Med. Press and Circ., July 3, '95).

Treatment.—In the treatment of congenital equino-varus in infants of from one to three months of age the main reliance must be placed on manipulations or stretchings. This stretching consists in endeavoring to straighten and replace the foot in its normal position by manual force. It is to be done by the mother or nurse three times daily. The following is the method of performing it: The leg is grasped, close down to the ankle-joint, by the left hand; the anterior portion of the foot is then twisted or rotated outward with the right hand, so as to first overcome the condition of varus present. This having been done the foot is flexed on the leg so as to stretch the tendo Achillis. In other words, the foot is first twisted outward until the ball of the big toe is in line with the internal malleolus and side of the leg and then flexed on the leg to bring down the heel. This is to be done several times at one sitting morning, noon, and night. In very young infants this is to be the only treatment instituted. If the infant is a

little older and robust, and the foot well developed the stretching can be done morning and night and on its completion a bandage may be applied. Flannel is best: from the toes to the knee. This has a distinct influence in correcting the deformity. If the child is older—say about the age of three months and even, in some cases, earlier—the bandaged feet may be placed in ordinary right-angled splints made of tin or felt. These should be padded with a little cotton and the bandaged feet placed in them. The heel should be brought down as well as possible by pressing the sole of the foot down on the splint and holding it there with one hand while the bandage is applied with the other. It facilitates matters to have one person hold the foot in position in the splint while another applies the bandage. As the child increases in age another method is useful. It consists in first bandaging the foot and leg in several thicknesses of flannel bandage (leaving the toes exposed for observation) and then applying over all a plaster-of-Paris bandage. The foot is to be held in the corrected position while the plaster sets. Too much should not be attempted at the first trials and one should see the child soon after the application of the bandage to see that the latter is not too tight. The toes constitute a fair guide: if these are pinkish and not blue and swelled one may be assured that the circulation is satisfactory. This bandage should not be left on longer than a week. On its removal the foot is to be bathed with whisky and alum or alcohol. Repeated applications of the plaster-of-Paris bandage will in a short time cause such improvement that if the child's foot is sufficiently developed some sort of permanent appliance may be tried. The most common appliance is a shoe fast-

ened to side-irons, which are hinged at the ankle. An elastic band goes from the foot to one of the side-irons and tends to flex the foot on the leg and thus bring the heel down. The shoe is laced down to the toes and a strap passes over the instep to hold the foot in place while the shoe is being laced. This brace should be removed daily, the feet bathed, and the brace reapplied and worn at night as well as during the day. In severe cases better command of the foot will be obtained by continuing the side-irons above the knee, a joint being inserted at the latter point.

Another form of splint, instead of the ordinary right-angled gutter-splint above mentioned, consists of a foot-piece cut in the shape of the foot and made out of quarter-inch-thick board. To this is fastened an iron upright which goes up alongside the leg, and encircles it half-way around just below the knee. The foot is firmly strapped to the foot-piece by means of adhesive plaster and covered with a bandage, which is carried up to the knee. The iron upright is then bent backward and its upper part hooked around the back of the leg, and the whole covered with the remaining portion of the bandage. This is to be changed every few days, and if the adhesive plaster causes soreness of the foot the latter is to be first covered by a bandage and then strapped with the adhesive plaster to the foot-piece. Recently I have modified this splint by inserting a joint at the ankle and fastening the upright to the foot-board by means of a hinge-joint. The iron goes up the inner side of the leg and a light rubber tube passes from the outer side of the iron upright at the knee to the outer side of the foot-board well forward. By its constant traction the elastic tends to correct the deformity.

The question of tenotomy will arise. In very young infants it is better not to resort to tenotomy at once. In many cases after a few weeks' treatment it will be found unnecessary. In some infants the deformity is so firm and resistant as to make it practically impossible to keep the braces or splints on or to bring down the heel. In these cases no hesitation should be felt in resorting to tenotomy. Usually a tenotomy of the tendo Achillis will be sufficient. In older and more rebellious cases tenotomy of the anterior and posterior tibials in addition to the tendo Achillis will be required. Also at times the contracted plantar fascia should be divided.

When the child attempts to walk, a walking-shoe should be ordered. This is similar to the night-shoe, except that it is made stronger and more suitable to stand the wear and tear of continued use.

As cases grow older so do the difficulties of treatment increase: The feet should be put up in plaster of Paris and held as nearly as possible in the corrected position until the plaster sets. After a few weeks' trial, if satisfactory progress is not made, tenotomy should be performed and the plaster reapplied until later on walking-shoes may be worn.

In still more severe cases more radical procedures are sometimes demanded. Of these the open section of the tissues of the inner side and sole of the foot as advised by A. M. Phelps may be tried. The cases of excision of the astragalus alone for equino-varus which have come under my notice have not seemed to me to be satisfactory. In those cases in which it brought the foot into fairly good position less radical measures would probably have been sufficient, while in the bad cases the deformity per-

sisted, even after the bone had been removed. This is only to be expected because in equino-varus both the inner and outer arches are disturbed, while removal of the astragalus simply affects the inner arch.

In the most severe cases, those varying in age from six years to adult life, I have resorted to wedge-shaped resection. This is done by making an incision over the cuboid and anterior part of the calcaneum and then gouging out the bone clear across the tarsus. The parts removed consist of the anterior part of the calcaneum and astragalus and either the whole or part of the cuboid, scaphoid, and the three cuneiform bones.

All feet at any age after the fourth month with shortened skin and ligaments should be operated on by open incision. The operation is not completed until the foot is placed in the supercorrected position, flexed upon the leg and the heel prominent so that it strikes the ground in walking before the anterior segment of the foot does. Club-foot shoes should be discarded for massage and manipulation, accompanied with fixation of the foot in the supercorrected position by a plaster-of-Paris shoe or adhesive plaster. Treatment begins immediately after the operation is completed. Osteoclasis should be performed in all cases of inward twist of the tibia, or a relapse may be looked for. Bone operations should never be performed primarily. Tendons and ligaments should be cut, and not stretched. No case is cured until the heel strikes the ground first in walking. Open incision should never be performed unless the skin resists and will not stretch sufficient to allow the supercorrective and the proper unfolding of the foot. The weight of the body falling upon any club-shoe or brace nullifies the action of the apparatus. Phelps (Brit. Med. Jour., Oct. 20, 1900).

Most writers on this subject advise beginning treatment as early as possible, at birth or soon after. The author differs from this view and doubts the

advisability of instituting treatment at this early stage, and prefers waiting until the child is able to walk. Appreciating the ossification periods and all the arguments advanced in favor of early treatment, yet he is not convinced that enough is gained to justify the continued interference with the nutrition of the child at the time when every effort must be directed to perfect the infant feeding and hygiene. The excoriations, strained tendons, and ligaments must surely inhibit digestion, and if digestion is inhibited, nutrition cannot satisfactorily proceed. Although he declines to treat club-foot in young infants until they are able to walk, he does not infer that nothing ought to be done during the first eighteen months. The severe forms of treatment should be mitigated, as it is well known that a large number of cases of moderately high degree are corrected by the hand of the mother. This good work should merely be supplemented by simpler forms of apparatus. V. P. Gibney (American Medicine, Oct. 29, 1904).

Talipes Equinus.—In talipes equinus the heel is elevated and the patient walks on his toes after the manner of a horse; hence the name. It is usually an acquired affection. In infantile paralysis the loss of power in the anterior muscles of the leg allows the unopposed muscles of the calf to draw the heel upward. For a certain length of time after paralysis has occurred the foot can be brought to its normal position, but, if no means are taken toward guarding against drawing up of the heel, the healthy muscles and tendo Achillis will permanently shorten and thus the deformity will be produced. It is a condition which commonly occurs as a sequence of injuries of the leg. In fractures, particularly if much violence has been done in the neighborhood of the ankle, and attention is not paid to the position of the foot, when the time comes for the patient to walk the foot

will be found to be more or less firmly fixed in the position of equinus. Again, after injuries of the deep structures of the back of the leg the same condition is produced. Cicatrices will not infrequently draw the heel up.

Treatment.—The treatment in cases in which this deformity is liable to occur should be directed to preventing it. In cases of infantile paralysis patients with toe-drop are liable to suffer from contraction. In order to avoid this an efficient brace can be worn consisting of a sole-plate and two side-irons (or even one) with a joint at the ankle which prevents the foot being extended to more than a right angle. It may be made to be worn inside the shoe or outside and fastened to the sole. In cases of injuries and fractures some splint or appliance should be used which prevents the heel from being drawn up. If the condition is already present when the patient is seen, if it is not too resistant, massage and manual stretching followed by the application of a right-angled splint will suffice to bring the foot to a normal position. This once accomplished, a walking-brace should be prescribed or a light firm splint—such as can be made of leather or silicate of soda—may be used to hold the foot at right angle. When the affection is of longer duration the tendo Achillis should be divided and the case treated as already detailed.

In old cases the plantar fascia will be found contracted as well, oftentimes, as the tendons of the toes. These should all be divided, the toes flattened out, the foot unfolded, and the heel brought down. In cases which have resulted from paralysis of the leg-muscles particular care should be taken not to unduly lengthen the tendo Achillis, or else control of the foot will be much lessened and walking will be made worse.

Talipes Calcaneus.

Diagnosis.—This may be either congenital or acquired. The foot is drawn up toward the leg and the heel is down. Division of tendons in these cases is not often required; all that is necessary is to apply some sort of splint or brace that will maintain the foot at a right angle. If the case is a walking one an apparatus with an ankle stop-joint that allows extension, but not flexion, will be required.

Shortening of the tendo Achillis may be performed in these cases. The tendon should be divided obliquely and the ends overlapped and fastened with a couple of fine silk sutures—introduced back and forth, as in a mattress-suture. The wound should be closed without drainage and the foot placed in a splint.

Pes Cavus.

Diagnosis and Treatment.—In certain cases of paralysis the heel assumes the position of calcaneus, as above described, while in addition the anterior leg-muscles are paralyzed, thus allowing the toes to drop. This condition allows the heels and toes to come closer together and consequently relaxes the normal tension on the plantar ligaments. This tendency is aggravated by the action of the anterior and posterior tibials, which, if healthy, will draw the arch of the foot up. Thus is brought about a hollowing of the sole of the foot, which is called pes cavus. The arch is raised, while the toes and heel are depressed. In treating it several indications are to be met: To aid in straightening out the contracted arch the plantar fascia should be divided. The anterior and posterior tibial muscles should not be divided, because in these feet there are already too many disabled muscles. An attempt may be made to shorten the tendo Achillis as detailed under the head of talipes cal-

canus. To keep the toes from dropping a steel sole-plate and side-iron brace should be used with a stop ankle-joint allowing flexion, but not extension beyond a right angle. To keep the foot flat on the sole-piece a strap should pass from side to side over the instep, or else particular pains should be taken to lace the foot firmly down in the apparatus. I have also used in these cases an apparatus with a vertical steel spring, which allowed a certain amount of both extension and flexion and then brought the foot to a right angle. A. M. Phelps has improved this appliance by adding a stop-joint that prevents sudden excessive movements from breaking the spring.

Pes Planus (Flat-foot).—Flat-foot consists in the flattening of the arch of the foot. It is usually, but not always, accompanied with pronation. Lovett has described a condition in which the symptoms of flat-foot are present with the exception that the arch does not appear to be flattened; to this he has given the name of the “pronated foot”; as its symptoms and treatment are practically those of a mild or early stage of flat-foot, it is included under that subject.

Flat-foot most often occurs in young children and adolescents, but is also common in adults. It has two principal causes: general weakness and rheumatism. There is a disproportion between the strength of the foot and the use it is subjected to.

This balance in the young is usually disturbed by the bodily weakness to which children are so often subject. The weakness of the muscles throws additional strain on the ligaments, and these consequently stretch and let down the arch. While some patients may exhibit evidences of trouble in other parts of the body, this is often not the case, and the

flattening of the arch may be the only evidence of disease that can be detected.

In adults the weakness of the foot is due to pain lessening the efficiency of the muscular support and to the rheumatic disease of the fibrous structures lessening their ability to perform their function. Patients in moderately fair condition, both generally and in respect to the feet, may have their strength overtaxed by excessive use. Thus, children working at occupations requiring them to stand continually, as weaving, will become affected.

Painful feet, especially the cases that are commonly called chronic rheumatism, will gradually be found to be due to flat-foot. This condition is treated by taking a piece of celluloid plate, three to three and one-half millimetres thick, warming it in water and fitting it to the foot. This is worn inside the shoe. This makes the most satisfactory plate that can be used. Schanz (*Deutsche med. Wochens.*, Oct. 16, 1902).

Functional flat-foot, which seems to occur easily in people of a gouty diathesis, following an injury, or with both conditions. There may be pain, pain only with injury, and varying grades of valgidity; or the valgidity varies when the patient stands, sits, or walks. Both pain and valgidity may be absent except with movement. The condition is frequent among soldiers. Herhold (*Deutsche Zeits. f. Chirurgie*, Jan., 1903).

Symptoms.—Pain and discomfort are the symptoms most complained of. This may be located generally in the foot, it feeling tired; or it may be localized, common points being often below and in front of the inner ankle, or on the dorsum near the ankle and in the instep generally. The sole of the foot becomes flattened out instead of preserving its natural hollow form. The instep sinks, and the foot on that account looks longer than it really is. It also becomes stiff, losing its flexibility. The peronei

muscles along the outer side of the ankle are often in a state of spasm and can be felt as hard cords along the lower end of the fibula and ankle. In rheumatic cases the foot usually looks thicker than normal; this is a characteristic sign, as it shows actual disease present. Pain is marked: often it can be elicited by moderate pressure over the bones and ligaments. Pain in the heel is another characteristic sign, and pains in the soft parts are apt to be present as well as in the bones and ligaments. Another important sign is a sweaty condition of the feet. The age of the patient also aids in diagnosis, and a history of rheumatism or pains in the other joints can often be elicited.

Injuries comparatively rarely cause the affection. Infantile paralysis may cause it, and, if so, other evidences of paralysis will usually be present.

Treatment.—The general health should be attended to. Diathetic disorders—such as rheumatism—should receive attention. Any exciting cause—such as excessive work, the wearing of improper shoes, or anything else that may tend to produce or aggravate the conditions—should be remedied. In the young, tonics should be given to build up the general health: strychnine, the hypophosphites, codliver-oil, quinine, and iron may be given. If the patient has been too closely confined in-doors, then a more out-of-door life is to be advised. In endeavoring to improve the local condition it is a good plan to order the patient to rest in bed for a week or two. This eases the pain at once and the spasm of the peronei muscles subsides. Then daily massage and manipulation should be given. This manipulation should have as the main purpose replacing the broken-down arch in its former normal position. To do this the

forepart of the foot is grasped with one hand and rotated from the outer toward the inner side. At the same time pressure should be made with the other hand on the sole of the foot below and slightly in front of the ankle so as to press the arch up. These two movements should be repeated many times twice daily—morning and evening. The foot should also be moved backward and forward so as to unlock the tarsal bones and render the foot more flexible. When the foot has been loosened up, the arch partly restored, and the pain gone, then the patient may be allowed to get out of bed. To strengthen the muscles the patient should be told to stand on the toes, raising the heels off the floor as far as possible, several times a day.

Shoes for infants should be distinctly right and left; the front of the shoe should be adducted, the inner edge straight, and there should be room along the straight inner edge for the front of the foot and the big toe to assume their positions of greatest strength. Adults should wear right and left stockings, preferably with a separate apartment for the big toe. J. A. Simpson (*Amer. Medicine*, Jan. 18, 1902).

To relieve the strain on the arch the weight of the body should be thrown on the outer edge of the foot. This is accomplished by raising the heel and sole on the inner side a quarter of an inch or more, also by using some additional mechanical support. This mechanical support may be given either by a separate insole or plate which is inserted into an ordinary walking-shoe or by a shoe which is specially constructed for the patient.

In some cases metal plates or insoles work well, but they are often unsatisfactory, and on that account in all serious cases and in many others I prefer a specially-constructed shoe. The plate

usually used consists of a sheet of metal, of the shape of the foot, which has been worked up on its inner edge so as to support the arch. In order to support the outer side of the foot and prevent it from sliding outward away from the plate Royal Whitman has added a projection on the outer side. A leathern insole braced with a metal strip can also be bought of instrument-makers. The objection to metal sole-plates are that they are hard to fit and be made comfortable, they require the use of a specially loose shoe, and many of them are liable to rust and break. Practically the only way of preventing the latter is to have them coated with hard rubber after being specially fitted to the patient, or to use some special, non-corroding metal. The shoe which I prefer is made on these lines: a steel shank is inserted between the layers of the sole, over this at the part of the foot which it is desired to support is placed a small pad so shaped as just to fill the hollow of the restored arch. The counter of the shoe is made extra strong, the inner edge of the sole and heel are raised a quarter of an inch, and if the case is an exceptionally bad one a small side-plate is riveted on the sole-plate and goes up on the inner side of the foot for an inch or two. This is covered by sewing over it a piece of leather. The shoe is to be a laced one, and not buttoned. In severe cases a side-iron may be added to this shoe, or an inside plate with side-iron and joint at ankle may be used.

Tenotomy of the peronei tendons may be performed, but rarely for cases in which spasm is quite marked.

The writer recommends the following procedure: A curved incision along the border of the structure of the foot, beginning below the inner malleolus, halfway between this and the sole of the foot, and ending forward at the base of

the first metatarsal bone. In the front part of the wound is seen the insertion of the tibialis anticus muscle, which is divided and isolated upward, toward the angle. Then the under surface of the bony ridge of the foot is laid bare about one centimetre outward, and then, with a trephine having the diameter of an ordinary lead pencil, a hole is cut from below upward, through the navicular bone. The opening of the tibialis

periosteum with stitches. Thus the arch of the foot is held up by this opening, as by a cord. The after-treatment usually persists for three or four weeks, and consists in massage and passive motion followed by careful active motion, never, however, without a suitable brace for flat-foot. When the muscles have all returned to health this may be cast aside. E. Miller (*Centralb. f. Chirurgie*, Jan. 10, 1903).

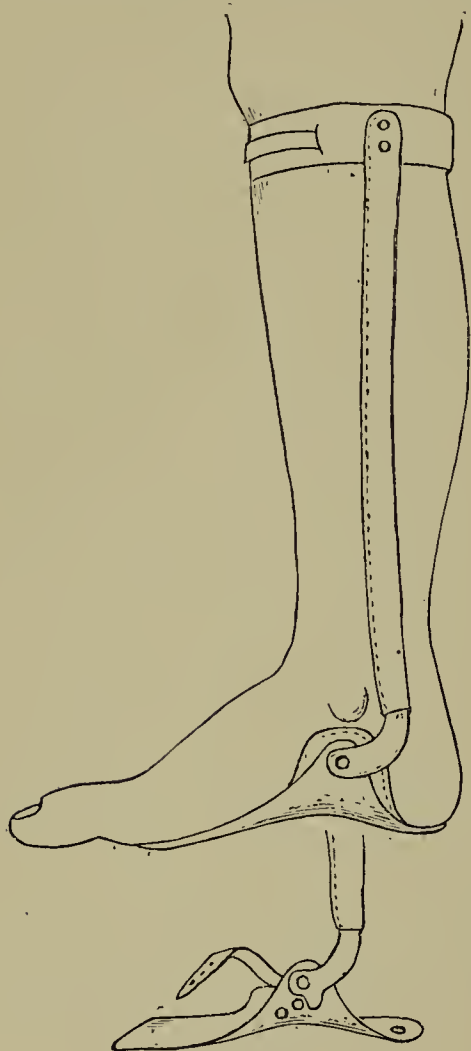
Pes Valgus.

Diagnosis and Treatment.—In valgus the foot is turned out instead of in. It is almost always an acquired affection and associated with calcaneus, as in cases of pes cavus already referred to. Its treatment is a combination of that used for pes cavus and pes planus. The tendency for the foot to turn out is overcome by using an apparatus with a steel sole-plate, and any tendency to too much flexion or extension is counteracted by a stop-joint. The brace can either be fastened to and incorporated with the sole-plate or the brace can be separate from the shoe and used inside of it. An advantage of the latter is that it may be used with different shoes, but it is not so efficacious as the former.

Knock-knees.

In knock-knees the legs, instead of being straight in line with the thighs, are inclined outward from the knee-joints. This causes the feet to be wider apart than natural and the knees closer together, so that in walking they knock against one another and interfere in walking; whence the name.

It is caused by an increased obliquity of the lower articular surface of the femur, together, usually, with an increased laxity of the ligaments of the knee-joint. The internal condyle of the femur projects downward farther than does the external. The increase in the internal condyle is on its lower, and not on its posterior, surface; so that the de-



D. W. Kolbe Co.

Brace for flat-foot, also for toe-drop from infantile paralysis. (G. G. Davis.)

anticus is then drawn through this hole with a sling of thread. The arch of the foot is then forced as far upward as it will go, and the tendon through the opening is drawn back as much as possible so that its end might be carried around the tuberosity of the navicular bone and below inward and upward, and fastened in this curved position to the

formity manifests itself when the legs are extended. When they are flexed they assume their normal position and nothing unusual is to be seen except, in marked cases, the projection of the internal condyle. The increased length of the internal condyle is not caused by a more rapid growth of the extremity of the condyle itself as of the whole substance of the inner side of the femur, for the epiphyseal cartilage is not transverse to the long axis of the femur, but is tilted so as to be almost parallel to the joint-surface. Associated with this condition of the bones is also a laxity of the ligaments of the joint, particularly those on the inner side.

Etiology.—The causes are usually malnutrition, weakness, or rickets, and the affection is often precipitated by some affection of the foot.

Thus when rickets plays a prominent part we find the disease occurring in childhood. When weakness acts as a cause we find it occurring in adolescents somewhat in the same manner as does lateral curvature or flat-foot, but earlier than these two affections. It is often associated with flat-feet, and it can readily be seen how the letting down of the arch of the foot tends to throw the knees inward. This influence, continuing for a long time, at last makes itself evident on the structure of the joint. A condition of valgus occurring from traumatism or other cause as paralysis may cause the development of knock-knee, but if there is no constitutional weakness these affections may exist without giving rise to any knee-troubles.

Symptoms.—If the condition is once suspected and looked for, there is usually no difficulty in diagnosing it, but it is liable to be overlooked. Attention is apt to be first attracted by either the child's stumbling and falling or else by its awk-

ward gait. In very young children they will begin to stumble and fall frequently or acquire a sort of waddling gait, and this after they have been walking naturally for some time. If on examination flat-feet are found, these may be subjected to treatment and the knees' condition be entirely overlooked.

Prognosis.—Knock-knees is not so apt to improve with growth as will bow-legs, neither does it respond so readily to treatment. On this account operative measures are more early resorted to.

Treatment.—The general constitutional condition of the patient should be attended to and remedies—such as cod-liver-oil and syrup of the hypophosphites—given. Hygienic and dietetic measures are also important. Considerable can often be accomplished by mechanical means, particularly in children under the age of six years, when the deformity is not too pronounced.

The form of apparatus usually employed consists of a waist-band to which are fastened two leg-irons: one going down on the outside of each leg and fastened to the shoe with a joint at the ankle. The knees are pulled outward toward the leg-irons by straps. Sometimes joints are introduced at the knees. When this is desired greater stability and efficiency is insured by having irons up each side of the leg instead of only the outer. A pad is placed on the inside of the knee and the braces are straightened, with wrenches from time to time as necessity requires. It is necessary that the leg-irons be firmly fastened to the shoe and that the shoe itself be strengthened so as to guard against an increase in the tendency to valgus.

When the deformity is marked or the parents are unable to give the case the attention which treatment by means of

apparatus entails, then resort may be had to operative means.

The operation employed is division of the bone, or osteotomy. Macewen inserts the osteotome on the inner side about a finger's breadth above the tubercle for the adductor-magnus muscle. The division is effected from within outward. The knee should be bent, as the artery is farther away from the bone in that position. Some make an incision through the skin through which the osteotome is introduced; this is not necessary. A better way is to place the edge of the osteotome on the skin at the desired spot and then by a gentle rocking motion cut through the skin. After completion of the operation a large dressing of gauze is applied, but no sutures need to be inserted. The legs are put up in a somewhat overcorrected position, either in plaster of Paris, which is best, or splints. Hahn advocated division of the bone on the outer side, and I much prefer it, because the bone is divided on the concave side instead of the convex, thus leaving a bridge of bent bone and periosteum to prevent undue displacement of the fragments, besides being easier of performance. The operation of Macewen, however, from the inner side is the one usually recommended. Cuneiform osteotomy with the removal of a wedge of bone is never done for this affection.

Bow-legs.

In bow-legs the concavity of the curve is on the inside instead of the outside of the limbs. Thus, the knees are unduly separated, instead of the feet. The bending, also, is commonly more gradual instead of angular as in knock-knees.

The causes are much the same, but the affection usually occurs between the ages of one and six years and less frequently in older subjects. It is more

commonly, also, of a distinct rachitic origin. The appearance of the limbs of the patient is so marked that it is less apt to be overlooked than is the case with knock-knees. In the latter affection, as has been said, a position of valgus is often assumed by the foot. This is turned so as to enable the sole to be placed flat on the ground. In bow-legs the sole has a tendency to incline inward; so that in order to bring the sole flat on the ground the feet are widely separated; therefore the feet are very far apart as well as the knees, and this gives a peculiar appearance to the patient, which is at once remarked by the parents.

The bowing may involve the tibia and fibula alone or the femur in addition. The knee-joint itself is not often affected. The curve is not always a lateral one, but may be in an antero-posterior direction, often combined with lateral bending.

Treatment.—The line of treatment to be pursued depends on the age of the child and extent and character of the deformity. As the nutrition of the patient is almost always at fault, particular attention should be paid to it. As it is evident that the child has not grown satisfactorily on its previous feeding and mode of life, the usual diet should be changed and the child be gotten out in the open air as much as possible and codliver-oil and hypophosphites given internally or the former rubbed thoroughly in the skin daily.

In endeavoring to straighten the limbs by non-operative mechanical means the child may either be kept abed or allowed to walk around. If it is desired to obtain the greatest possible correction in a short time the child is to be kept in bed and the limbs bandaged to each side of a splint placed between them. When

the curvature is confined to the bones of the leg a very efficacious method is the following, which I devised some years ago: A pad is placed between the ankles, and these are then firmly fastened together with a bandage; another pad is placed between the knees, and they likewise are bound firmly together. The legs are then covered with a plain muslin bandage and directly across from one leg to the other at the point of greatest curvature is placed a rubber bandage. This by its continuous pressure tends to obliterate the curve. Care should be taken not to apply the rubber bandage too tightly.

If the child is to be allowed to walk around freely braces must be employed. These are often made of a single inside bar. This form, however, is not so firm, nor does it make so efficacious pressure as does a double brace. It is best to have a brace made with two side-irons jointed at the ankle and knee. A pad is placed over the inside of the ankle, another at the knee, and a third on the opposite side of the leg. By bending the apparatus every few weeks any desired degree of pressure can be obtained. It is highly desirable to carry the apparatus above the knee so that rotation be prevented. A fairly efficient apparatus can be made for very young children without any ankle-joint, as it is hardly so essential in them as in adults.

In cases of antero-posterior curvature an apparatus with two side-irons and a pad strapped over the projecting bone and fastened to the side-irons is of service, but the results are not so good as in lateral curves. In young children with soft bones correction can be effected by manual force and the limb placed in a plaster-of-Paris dressing.

In more stubborn cases osteotomy or osteoclasis may be utilized. Personally

I do not like osteoclasis, and prefer an osteotomy. This can be done through an opening sufficient only to admit the chisel. To break the bone I prefer an osteoclast to manual force, as it necessitates less division of bone. The bone is thus accurately broken at the desired spot without undue violence.

In antero-posterior curvature it is very often necessary to resort to a wedge-shaped resection of bone; this is an operation of considerable gravity, and the utmost care must be taken to employ a reliable aseptic technique.

Hallux Valgus.

This is a displacement of the great toe outward; it is usually associated with enlargement of the bursa and tissues on the inner side of the metatarso-phalangeal joint. In its most marked condition the cause is usually rheumatic or rheumatoid in nature, although severe cases occur even when no other symptoms pointing to those affections exist.

TREATMENT.—Conservative treatment may be tried with a small internal lateral splint of pasteboard to which the toe is drawn over by adhesive plaster or by means of a metal spring fastened to a sole-plate and made by the surgical-instrument maker. Radical treatment consists in excising the hypertrophied and inflamed tissues over the projecting part and removal of the head of the metatarsal bone. Care should be taken not to remove too much, or a flail-joint may be left and walking interfered with. For this reason it is preferable not to remove both articular surfaces.

Osteotomy of the metacarpal bone has been done, but it is only effective in comparatively mild cases.

In hallux valgus removal of a portion of the head often fails to afford relief. Total resection of the joint does not overcome the deformity due to inward inclination of the metatarsal bone, and

results in ankylosis, while tenotomy of the extensors of the great toe may be followed by suppression of the function of these muscles. Cuneiform resection of the metatarsal bone near its base, but in front of the insertion of tendon of peroneus muscle, recommended. Loison (*Bull. et Mém. de la Soc. de Chir. de Paris*, No. 17, 1901).

Once having removed the infected bursæ, the skin incision is made according to Dawbarn, except in cases with a tender bursa. In these cases the bursæ should be excised and as much of the overlying skin as is compatible with complete closure of the wound. The next step is to free the inner portion of the distal end of the first metatarsal with a chisel or periosteotome. The inner one-half or two-thirds of the head of the bone is then removed with bone forceps. The outer one-third or one-half of the articular surface of the metatarsal and the phalanx are not disturbed. The extensor tendons of the great toe are then divided. The fascia and ligaments are then drawn together with catgut and the skin approximated with silkworm gut. The toe is held in proper position with a plantar splint and adhesive plaster. The author usually applied a constrictor before operating, but, without constriction, the hæmorrhage is slight. J. G. Sheldon (*Medical Record*, Oct. 31, 1903).

Coxa Vara.

This is the name given to a condition in which the neck of the femur is so altered in relation to the shaft that the direction of the thigh is changed. The foot thus may be abnormally everted, and excessive adduction be present, producing a scissors-like deformity.

Twenty-two cases of coxa vara. It is much more common than is supposed, and many cases are treated as cases of tubercular disease.

Coxa vara is to be detected only by physical examination. The points developed are: the trochanter is elevated, prominent, and displaced, as may be demonstrated by Nélaton's line and Bryant's triangle, the actual shortening of

the leg, and the peculiar and unequal limitation of the range of motion dependent upon the deformity. In progressive cases the forced passive motion causes discomfort, and at times it may be resisted by voluntary and involuntary contraction of the muscles. This is, however, unusual. There is commonly a certain amount of muscular atrophy, more marked in the thigh than in the leg, which corresponds to the duration and to the degree of the disability.

Coxa vara is probably the result of an inherited or acquired weakness, either of position or structure; it may be the important predisposing cause of the deformity. Exciting cause would be the instability of rapid growth, overstrain, overweight, and injury. Improper surroundings, insufficient nourishment, or debility from any cause undoubtedly lessen the resistance of the bones as of other parts, but the presence of actual local disease is by no means necessary to explain the deformity. Whitman (*N. Y. Med. Jour.*, Jan 21, '99).

In the presence of the positive findings which present themselves in every case of infantile coxa vara, no one can deny the importance of rickets as an etiological factor in this condition. In the absence of any practical points in the etiology of the condition in the young adult one is obliged, theoretically at any rate, to accept the presence of some acute bone-softening process. Although in the bulk of all cases this condition may be justly considered one of kin to osteomalacia, yet there are a certain number of cases which point strongly to a true late rachitic process. M. Haedke (*Deut. Zeit. f. Chir.*, Nov., 1902).

Osteotomy may be necessary to obviate some of its discomforts and disabilities.

Hammer-toe.

This is a permanent contraction or cramping of one or more toes in which they project up above the rest. Corns form on top, owing to rubbing of the shoe.

TREATMENT.—The most effective and surest remedy is to amputate the toe at the metacarpal joint. This may seem radical, but, while, by dividing the flexor and extensor tendons and even the lateral ligaments, the toes may be straightened, still in a few months the deformity is apt to recur.

If resection of the joint is performed it is apt to leave a wobbly, loosely-attached, toe which tends either to be pushed up above the level of the other toes or else to become caught under one of the toes on either side and form a condition of affairs as annoying as was the original affection.

The writer recommends the following operation: By means of a semilunar incision on the convexity of the toe he cuts a cutaneo-tendinous flap, incises the capsular and lateral ligaments of the joint between the first and second phalanges, isolates the first phalanx, and cuts off a sufficient portion of its head. He then cuts the flexor tendon half through by an incision at right angles to the tendon near its insertion, and by longitudinal incision creates a strong "tongue" of tendon, which is brought up between the first two phalanges and sutured to the extensor tendon. He thus brings about an equilibrium between the actions of the antagonistic tendons. Finally, before suturing the skin he removes what is superfluous, as well as any callosity that may have formed. The operation is a modification and completion of that of Terrier, and the author states that the result is a radical cure. A. Perassi (*Ann. d. Med. Nav.*, Jan., Feb., 1903).

Webbed Fingers.—When these are congenital they may be cured by raising a wedge-shaped flap from the base of the dorsal aspect of the web and slitting up the remainder. The flap is then turned in between the fingers and sutured in the palm and the raw surfaces on the sides of the fingers approximated as much as possible.

The essential part of all operations for this affection is to get a healthy strip of skin to heal nicely in the base of the web, thus preventing a cicatricial band forming at this point.

Club-hand.—This term is applied to a rare condition of the hand corresponding to club-foot. It may be congenital, as a result of defective development, or may be caused by any traumatism capable of inducing paralytic contraction. The congenital variety is usually associated with deformity of the lower end of the radius or ulna and with other congenital malformations. The hand may be fixed in extreme flexion or extension, or it may be deviated laterally, thus constituting varieties resembling those observed in club-foot. In the majority of cases, however, the hand is drawn toward the radial side and flexed.

TREATMENT.—Passive motion and persistent efforts to place the fingers and hand in their normal position, a retentive apparatus or plaster dressing being used, are sometimes followed by improvement. Frictions and galvanism of the muscles involved tend to assist the curative process. Tenotomy does not enjoy the confidence of surgeons, as a rule, and is thought by many to be more harmful than beneficial.

In club-hand, section of the tendons, ligaments, or fascia may be necessary if the case is not seen in the early stages. If the flexor tendons have to be divided, it would seem better to operate in the forearm instead of the hand, and to split the tendons longitudinally, and, after having gained the required additional length by sliding the ends past each other, to suture them together once more. Bilhaut (*Annales d'Orthopédie*, May, '93).

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OSSEOUS SYSTEM, DISEASES OF.

Periostitis.—Inflammation of the periosteum.

SYMPTOMS.—In an ordinary acute periostitis following injury there is a localized swelling, redness, heat, and pain—which is usually worse at night. The tenderness is exquisite and the use of the part is much interfered with. A spindle-shaped thickening can often be felt, often due to detachment of the periosteum from the underlying bone. The anterior surface of the tibia, being most exposed, is the most frequent site of the trouble. When no infection occurs from purulent micro-organisms, suppuration may not occur. If, however, the acute form supervenes during some infectious disease, suppuration is apt to take place, and constitutional symptoms—severe in proportion to the extent of the inflammation—ensue. Diffuse periostitis is a serious variety in which the inflammation spreads rapidly, sometimes including the periosteum of the entire shaft. It may reach the epiphyses and the joints and reach deeply into the osseous tissues, as far as the medulla. Pyæmia sometimes appears in these cases and generally ends fatally.

Periostitis frequently follows injuries; it may also arise spontaneously as a sequel to variola, typhoid fever, scarlet fever, and other infectious diseases. The complication, as a rule, however only occurs at the end of convalescence. After typhoid fever the tibia is usually implicated, and the jaws after scarlatina and measles. Periostitis more frequently occurs as a complication in the young than in the adult.

It may be primary or secondary as the result of inflammation of the underlying bone or the medulla. In syphilitic and tuberculous subjects a local periostitis may arise without any discoverable

traumatic cause. It is probable, however, that in many of these apparently idiopathic cases there has been a previous unnoticed trauma, but of a degree which would not have affected a healthy periosteum.

PATHOLOGY.—The morbid changes consist in a temporary thickening of the periosteum, followed by rapid cell-proliferation and the formation of inflammatory lymph. The parts may remain thickened or hardened (sclerosed), though the underlying bone, through defective nutrition, becomes soft. Diffuse inflammation so reduces the osseous nutrition sometimes as to cause death of bony areas: necrosis. (See **OSTEOMYELITIS**, farther on.)

TREATMENT.—Many cases of periostitis are kept active by the continued irritation of the part through lack of rest. The muscles being inserted in the periosteum, their contraction disturbs the latter, and the periostitis cannot subside. The first indication, therefore, is to order the patient off his feet. Not only should this be done, but all movements of the affected member should be prevented by incasing the limb in a plaster-of-Paris dressing or securely bandaging it to a splint.

Local depletion is also efficient. Leeches may be applied or multiple punctures of the swelling may be made with a slender tenotome or cataract-knife. Instead of these punctures, a subcutaneous incision may be made through the swollen tissues down to the bone. In chronic, troublesome cases in which the upper layers of bone are involved, making an incision down to the bone and then boring several small holes into it—the aim being to relieve tension—and finally putting the limb in plaster of Paris has been followed by the most

gratifying results in my hands. To wait for the formation of pus in these cases before operating is, in the highest degree, undesirable, as an earlier boring of the bone cuts short the disease at once and prevents the occurrence of suppuration.

Ostitis.

Inflammation of the osseous tissue proper is seldom, if ever, witnessed as a primary affection and without involvement of the medulla. The osseous structure is often involved, however, in periosteal and myelitic disorders. The symptoms are described under *periostitis*, but they are somewhat more marked as regards pain and tenderness, while greater ambulatory impotence exists.

ETIOLOGY AND PATHOLOGY.—After a bone injury, as in the case of fracture, blood and serum are effused at the affected spot. The periosteum and surrounding parts become infiltrated with leucocytes. From the periosteum and the adjacent bone stellate cells are proliferated. The effusion in which they occur becomes first hardened and striated and lime-salts are deposited. The stellate cells become full-fledged osteoblasts, which finally develop into bony tissue. In cases resulting from simple injury the natural state of affairs is soon re-established, but occasionally an anomalous course is pursued. The bone may become uniformly increased in all dimensions, constituting a true **HYPEROSTOSIS**, or, if the density is increased as well as thickness, an **OSTEOSCLEROSIS**.

In this disorder the bones of the head are most often affected, and the disease may last many years. When ostitis attacks the bones of the face a very peculiar appearance results, to which Virchow has given the name **LEONTIASIS OSSIIUM**. The disease begins in youth

in otherwise apparently healthy persons and lasts many years.

OSTITIS DEFORMANS.—This is a disease described by Sir James Paget in which many of the bones of the body are affected with osteosclerosis. A large proportion of the cases die from malignant disease.

Forty-one cases of ostitis deformans have been reported. It is manifestly a distinct general disease, arising from nutritive disturbances, although the cause



Leontiasis ossium. (Sutton.)

is yet unknown. The frequency with which the disease is followed by malignant tumors emphasized. Thibierge (*Arch. Gén. de Méd.*, Jan., '90).

Ostitis deformans, according to Hutchinson, chiefly belongs to the senile periods of life; it may occur in either sex, but is more frequent in men; it often happens to those who have a gouty family history. It consists of a process of ostitis and periostitis, attended by the abundant formation of ill-developed new bone and the weakening,

to some extent, of the old. It is often in the early stages restricted to one bone, and tends in all cases to become generalized, involving all the bones of the body. It has no connection with syphilis, although it may be stimulated by it, especially by the hereditary form, and it runs a very chronic course, lasting ten to twenty years. Of itself, it rarely causes death.

Osteomyelitis.

Osteomyelitis is an acute inflammatory disease which originates in the spongy and medullary tissue of bone, but not in the compact tissue.

Symptoms.—It usually begins with a chill, soon followed by severe pain in the affected part, sometimes by redness and fluctuation and severe constitutional disturbance, including a high temperature. In young children the disease may traverse the epiphyseal cartilage and affect the neighboring joint. A mild case may be attended by very slight symptoms and proceed to recovery. When the suppurative form is present, however, there may be a prominence over the affected area or a fungous abscess into which the probe readily sinks deeply. Periostitis, which is invariably present, however, may mask the true nature of the case. After the femur and tibia, the vertebræ are the most frequent seats of this affection; an abscess forms which tends to break down the vertebral column, or bring about meningitis and myelitis by penetration, and thus cause paraplegia. Curvature of the spine is seldom observed, however. Severe cases may end fatally as a result of pyæmia or septicæmia.

Study of 106 cases of acute osteomyelitis in the vicinity of the hip-joint from the clinic at Tübingen. It may originate in the acetabulum or more commonly in the upper end of the femur; many cases run their course without suppuration;

extensive necrosis is exceptional; separation of the femoral epiphysis is usually accompanied by destructive changes in the joint. It begins with shivering, high fever, and severe pain. The hip soon presents a uniform, doughy swelling, and, if suppuration occurs, it usually makes its way to the surface, and results in multiple sinuses. Among the sequelæ may be contraction or actual ankylosis, separation of the epiphysis, and spontaneous fracture of the neck of the femur. Dislocation occurs in nearly one-third of the cases, usually backward and upward. The disease terminated fatally in 7 per cent. of the cases. Bruns and Housell (*Centralb. f. Chir.*, Mar. 2, 1900).

The vertebral column is rarely the seat of the acute infectious osteomyelitis. Sixty-two cases have been collected and analyzed in the present communication. Great diagnostic difficulties are sometimes encountered, owing to the immediate relation of the spine to the vital organs of the thoracic and abdominal cavities and the spinal cord and its membranes. Hence retropharyngeal, mediastinal, retroperitoneal and paranephritic abscesses, pelvic abscesses, peridural suppurations, and general pyæmia may be mentioned among the more important complications. Peridural abscess or suppuration occurred in 24 of 62 cases. Of these, 15 cases presented grave symptoms of compression of the spinal cord. The essentials of the clinical picture consist of the symptoms of a severe general infection, associated with the local signs of an inflammatory process of the spine, *e.g.*, excruciating pain and tenderness, œdema and fluctuation. The mortality of the affection is 50 per cent. Immediate and thorough surgical interference is the only treatment. Some systematic writers accept, and cases are recorded of, a primary suppurative perimeningitis or idiopathic suppuration of the loose peridural areolar tissue. Twenty-four cases of the so-called primary suppurative perimeningitis were collected, 11 of which presented sufficient data for purposes of analysis. J. Ramsay Hunt (*Medical Record*, Apr. 23, 1904).

NECROSIS.—Death of bone may not

only be due to osteomyelitis, but, also, as already stated, to periostitis. Whatever be its pathogenic source, however, it ensues as a result of defective nutrition due to interference with the supply of arterial blood. This occurs when the medullar or periosteal lesion that may be present leads to destruction of the Haversian canals. At times the deficient nutrition may be due to numerous emboli originating in a remote region—in the heart, for instance, during endocarditis. Metastatic necrosis is also occasionally witnessed in the course of infectious diseases, the result probably of bacillary invasion. Under **JAWS, DISEASES OF**, the necrosis brought on by phosphorus has been carefully reviewed. The influence of malnutrition of osseous tissue is readily shown also in dislocation of the astragalus; notwithstanding its replacement and the fact that no external lesions exist, this bone may undergo necrosis. The influence of fractures is also well known, especially when comminution disrupts its trophic supply.

When a long bone is attacked, the whole shaft may be involved or only that part of the diaphysis near the epiphyseal line. The periosteum forms new bone over the dead tissues or sequestrum and a suppurative tract or sinus leads from the sequestrum through the surrounding shell of bone to the exterior.

Etiology and Pathology.—Osteomyelitis is the result of an infection from one of the pyogenic organisms, either a streptococcus or staphylococcus. The disease is usually started by some slight injury, particularly in children previously debilitated by the infectious fevers.

In the negro race childhood and early manhood are most prone to the disease. Cold, traumatism, and overexertion are frequent existing causes.

Study of 403 cases of acute osteomyelitis of the long bones. Shows that the

male sex preponderates over the female in the proportion of 3.38 to 1. A large percentage, 42, falls between the ages of 13 and 17. Below 6 and beyond 19 there is considerable decrease; beyond 19, almost extinction. Three-fifths of all cases occur in the larger cylindrical bones, 38 between tibia and femur,—the latter more in the lower third, the former more in the centre of the shaft; 20 per cent. multiple. In 189 of the entire number more or less aggravated disturbance of the adjacent articulations remained. Haaga (*Beit. zur. klin. Chir.*, vol. v, No. 1, '90).

Series of 32 cases of osteomyelitis in children. Staphylococci were found in 11 cases; streptococci, typhoid bacilli, and pneumococci in 1 case each. In young children the prognosis is grave; otherwise the results were excellent. Death occurred in 12.5 per cent. Gonser (*Jahrbuch f. Kinderh.*, July, 1902).

In 167 cases of osteomyelitis the joints were affected in 48. The disease was located in the diaphysis of the femur in 45; in the upper epiphysis in 15; lower epiphysis in 3; diaphysis of humerus, 18; upper epiphysis, 1; lower, 4; diaphysis tibia, 45; upper epiphysis, 3; lower, 1; diaphysis fibula, 5; lower epiphysis, 1; diaphysis radius, 4; upper epiphysis, 2; upper epiphysis ulna, 2; distal epiphyses metatarsals, 3; upper epiphyses metacarpals, 1; diaphysis phalanges, 2; and the lower epiphyses in 1 case.

The osteomyelitis was usually found in young individuals, generally before puberty. Traumatism did not seem to play an active part in the production of the epiphyseal osteomyelitis. In the cases in which a bacteriological examination was made, the staphylococcus aureus and albus were found. Becker (*Deutsche Zeit. f. Chir.*, March, 1902).

The pathology of bone-necrosis corresponds to that of gangrene observed in soft tissues. Dead bone is separated from living bone by a line of demarkation of inflammatory origin: a rarefying ostitis. This tends to isolate the dead bone, which then becomes a sequestrum. It may, if small enough, be absorbed after

undergoing disintegration; if large, it may persist a long time imbedded in pus, which finally finds an issue. The enveloping shell,—the involucrum,—if it contains a sufficient quantity of pus, becomes perforated, and, this perforation leading to the surface, a fistula is formed. The reproduction of bone in necrosis due to simple inflammatory causes is sometimes remarkable when the subject is strong. Indeed, there is sometimes overproduction, elongation of a limb being thus brought about, especially an injury requiring prolonged sojourn in the recumbent position.

Treatment.—When a joint is affected it may first be aspirated; if the effusion is marked or if the case is sufficiently alarming the articulation may be laid open, washed out, and drained or even the joint resected.

In case the long bones are involved free incision and drainage should be resorted to in order to cut short the systemic disturbance and allow time for the periosteum to become sufficiently thickened to allow of its being pushed aside while removal of the affected bone is being accomplished.

In some cases longitudinal section with Hey's saw, and curettage are required to totally evacuate the contents; a small trephine may be used when the accumulation is not readily accessible and the purulent material is thickened.

Necrotic sequestra are readily recognized by the grating sensation transmitted through the probe. They should be removed when free in the cavity, which their mobility will readily indicate. It is usually necessary to enlarge the opening. When the piece is large a gouge or chisel is necessary to thoroughly remove all dead bone. The Es-march bandage should be used to avoid hæmorrhage.

When after the removal of dead bone a long and deep gap is left, an effort should be made to encourage the production of new bone. Bits of human bone will grow and develop if the chips are thoroughly aseptized, but it often suffices to make the transplantation from the bone of a living animal. Animals' bone, ivory, and other aseptic organic materials can be made to become healed in, and absorbed, capsulated, and partially or totally substituted by the growing bone in which they are planted and to which they furnish the irritation for osteogenesis.

Comparative study of 54 collected cases. The treatment of acute osteomyelitis should consist in bold and early incision of the infected joint. There is much difference of opinion among surgeons as to the extent of the operation to be performed, some being content with simple arthrotomy while others advocate trephining of the neck of the femur, and others again insist on the necessity of resection of the upper extremity of the bone. There can be no single plan of treatment suitable in all cases, and the indications for this or that method will vary according to the special conditions of each. In incising the soft parts over the affected joint the posterior method of Langenbeck is preferred, as this affords more complete drainage than incisions made over the front or the inner surface of the neck of the femur. There can be no doubt that good results have been obtained from trephining and even from simple arthrotomy, but in many cases resection of the head of the femur is indicated by the necessity of obtaining good drainage. This operation, however, is a difficult and dangerous one, and when successful leaves the patient with a shortened limb. In considering this problem the author suggests that in some cases it may be found sufficient to practice Broca's method, which consists in a free arthrotomy with removal of the surface of the neck of the femur. This method, it is acknowledged, is applicable only to cases coming under sur-

gical observation at an early stage of the affection. When the tissue of the upper extremity of the femur has been much disorganized, and the head of the bone is detached from the neck, there ought not to be any hesitation in performing resection. In such cases, which form the majority of instances of the disease first seen by the surgeon, arthrotomy is insufficient, as it leaves the patient exposed to the dangers of septicæmia infection, and resection is the only resource. Guyot (*Rev. de Chir.*, Nos. 2 and 4, 1904; *Brit. Med. Jour.*, June 25, 1904).

In cases in which the bone is extensively diseased, or gangrenous osteomyelitis is present, or when through extensive suppuration the patient's life is clearly endangered, amputation is indicated. This is especially the case when a long bone is implicated. In such a case, however, the bone should be removed entire, section in its continuity being, as a rule, followed by recurrence.

Rickets.

Rachitis, or rickets, is a disease of infancy and childhood due to malnutrition of the osseous structures.

Symptoms.—Nocturnal restlessness, night-sweats (especially of the scalp), enlarged abdomen, and phosphaturia are the early symptoms of this affection. The osseous involvement appears soon afterward and consists of epiphyseal enlargements, of which the end of the radius, the ribs, and the vertebræ are the most frequent seats. The costal disorder is followed by the deformity usually called "pigeon-breast." The frontal eminences and other portions of the facial bony frame-work are often enlarged; the fontanelles are frequently patent and the growth is often impaired. Such children are usually susceptible to catarrhal affections of the entire respiratory tract, nose, throat, and lungs. Deformity of the spine and other bones occurs as a result of the softening.

Probably the most pernicious effect of this condition is its influence upon the female pelvis, distortion of which when adult life is reached impedes and sometimes totally prevents parturition.

Etiology and Pathology.—The predominating features are that the epiphyseal ends of the bones are thickened, and that the bony tissue which forms



Rachitic scoliotic skeleton. (*Grandin and Jarman.*)

is deficient in lime-salts. Hyperæmia of the osteogenetic tissues first causes growth of the cartilage at the epiphyseal line, which becomes enlarged and irregular in histological structure. The bones are so soft that they can easily be cut, and the ligaments are elongated. When curvature of the spine ensues, we have *scoliosis* (see SPINE, DISEASES OF) or *lordosis*; the pelvis may also become

kyphotic. The skull may become thinned: a condition recognized as *craniotabes*, and its enlargement forms the physical basis of hydrocephalus (*q. v.*). Many of the deformities considered under ORTHOPÆDIC SURGERY are due primarily to rachitis.

Poverty, unhygienic surroundings, deficient food, artificial infant-foods, dampness, insufficient ventilation, etc., represent the etiological factors which environment procures. Hence the greater prevalence of rickets in crowded cities, especially those of the poorer countries of Europe, and among our negro population. It usually appears as soon as the child tries to walk, and may be congenital.

None of the accepted theories are supported by the results obtained in treatment. In all the writer has records of 803 cases, but 326 of these are not considered for various reasons. Of the remainder 150 were seen prior to 1901, and were treated by the Kassowitz method with phosphorus. Fifty were treated with codliver-oil, 150 were put on monobasic calcium phosphate, and 127 received no medication. The results are tabulated: The patients on the monobasic calcium phosphate showed improvement in 81.2 per cent.; those upon codliver-oil in 82 per cent.; those treated with phosphorus 81 per cent., while those without medication had a percentage of 82.7. There was remarkable uniformity in the results no matter what the medication. P. W. Nathan (Medical News, Feb. 27, 1904).

Treatment.—In the treatment of rachitis the first essential is to make a positive change in the diet of the patient. Fresh and nutritious foods should replace the ordinary diet, and all prepared foods for children should be strictly avoided (see NURSING AND ARTIFICIAL FEEDING). Codliver-oil is the best medicament. It should be given internally and rubbed into the

skin externally. The compound syrup of the hypophosphites and lactophosphate of lime are sometimes of service, but codliver-oil is almost a specific. Hygienic measures, such as out-door life (the patient being wheeled out in a carriage, if need be), salt-water bathing, and residence on the sea-shore are of great value, but unfortunately the latter is seldom within the means of the patient. To prevent the occurrence of deformities and to correct them the child should be kept off its feet and splints or apparatus applied. If the disease is marked, deformities will occur even though the child does not stand on its feet.

Osteomalacia (Mollities Ossium).

This is a softening of the bones in adults which occurs most frequently in nursing-women.

Symptoms.—The early symptoms of this disease are often obscure, the pain and muscular weakness complained of often leading to a diagnosis of rheumatism or suggesting some disease of the spinal cord. The progressive softening of the bones, however, soon leads to deformities, which gradually increase in degree and extent. The bones of the spinal column and the pelvis suffer most, the latter giving rise to great decrease in the pelvic diameters and the former leading to decrease in height. The patient assumes a waddling gait through the pelvic changes. Fracture of the long bones from muscular action is often observed. Death is usually due to exhaustion or pulmonary disease. In rare cases the disease sometimes becomes arrested.

Diagnosis.—While rheumatism may be suggested early in the history of a given case, a diagnostic point of importance soon supervenes to indicate the true nature of the trouble, namely: the numerous painful areas. The sex of the patient,

the possible presence of pregnancy, the presence of lime-salts in the urine, and the peculiar deformities witnessed, all serve to identify the affection.

Etiology.—The disease is almost always observed in women. Fehling has wrongly asserted that it never occurs in men. Though most authorities state that it does not attack childhood, it has been observed as early as the fifteenth year (Siegert, Münch. med. Woch., Nov. 1, '98). It is usually ascribed to defective osseous nutrition, through disorder of the trophic nerves, to deficiency of lactic acid, and to disease of the genital apparatus; but none of these may be said to have been positively demonstrated.

Pathology.—The morbid anatomical changes observed in osteomalacia are not always the same. In some cases bone-absorption is the chief element, in others the disappearance of earthy salts; but decalcification appears to be the earlier process, and it is only later that the organic portions are absorbed. In the long bones the medullary cavity is found enlarged, and the whole bone more cancellous; and as the disease advances the periosteum is stripped off, and a number of openings are seen, from which a clear fluid exudes. Fehling regards increased vascularity and friability of the ovaries as characteristic of the disease; and a hyaline degeneration of the arteries has been observed. Winckel and Kleinwachter deny that these changes are characteristic. (Ritchie.)

Treatment.—Phosphorus, which is of no particular value in rickets, is sometimes very effective in this disease. The most successful method is that of Kasminski, who gives it with codliver-oil. He first gives two teaspoonfuls a day of a mixture containing $\frac{1}{3}$ grain of phosphorus and 3 ounces of codliver-oil. He

then gradually increases the daily dose until 6 teaspoonfuls are taken daily, the patient being closely watched. The mouth must be kept scrupulously clean. The treatment lasts from four to fourteen months.

Another method tending to favorably influence the disease is removal of the ovaries, as proposed by Fehling. This has frequently been followed by success.

When removal of the ovaries and uterus cannot be carried out, pregnancy should be avoided, since child-bearing tends greatly to aggravate the disease.

Among the less effective—though valuable—methods are long-continued warm baths, salt baths, bone-marrow, and chloroform,—though the last has hardly been sufficiently tried to merit confidence.

Fragilitas Ossium.

The term “fragilitas ossium” is attributed to abnormal brittleness of the bones, due mainly to rarefaction, and predisposing the sufferer to fractures under the influence of slight traumatism, falls, and occasionally without assignable cause. Successive fractures of many bones may thus occur; but, rapid recovery ensuing, the only result is gradually-increasing deformity of the patient as a whole and the gradual loss of ambulatory powers.

ETIOLOGY.—In the majority of cases fragilitas ossium is an inherited dyscrasia, the origin of which is still unknown. It is at times associated with malignant growths, syphilis, rickets, general paralysis, locomotor ataxia, and after injuries involving lowered nutrition of the bony structures through long confinement in bed.

TREATMENT.—Once recognized, prophylactic measures calculated to avoid traumatism and other fracture-causing factors are alone indicated.

Bone Tuberculosis.

This name is applied to a chronic tuberculous inflammation of the osseous structures, which may be diffuse or local, superficial or deep. Superficial bone tuberculosis is termed *caries* by some authors: a term which formerly was attributed to what was thought to be a special form of necrosis.

Symptoms.—Pain in the affected region, stiffness of the overlying muscles and of the nearest joint, localized tenderness to pressure, and slight increase of local temperature constitute the first series of symptoms observed. The pain is deep-seated, but not sharp; the tissues may feel boggy and are sometimes slightly tumefied, owing to interference with the circulation, as indicated by the enlargement of superficial veins occasionally observed. As long as the inflammatory process is in its incipency, the general health does not suffer. As soon as the bone-tissues begin to disintegrate, however, and pus and tubercular deposits are formed, and caseation occurs, the local manifestations become decidedly more marked and constitutional symptoms appear: those of distinct pyæmia of slow development. The pain is much greater; pus-channels and fistulæ are formed. When the purulent products are evacuated through the latter, however, the general health becomes improved. The fact that the disease may be arrested by removing the purulent foci indicates the pathogenic influence upon the general organism. The vertebræ, the upper end of the femur, the bones of the hands and feet, and the elbows are the regions most frequently involved. Under SPINE, DISEASES OF; HIP-JOINT DISEASE; and JOINTS, DISEASES OF, this important subject is fully treated respecting the parts named. The

spina ventosa of the fingers is a tubercular disorder.

In some cases the characteristic symptoms are totally absent, even though the disease is steadily advancing; indeed, months often elapse before the tumefaction is sufficiently large to attract attention.

Tubercular foci in bones, when no sequestra are formed, may heal spontaneously, but in the presence of such the parts never undergo resolution. Of 314 cases studied by Riedel (Centralb. f. Chir., Feb. 18, '93), nearly 46 per cent. were devoid of sequestra. These may be discovered by means of the probe through a fistulous opening. The prognosis depends upon the ease with which operative proceedings can be resorted to.

Diagnosis.—The slight general manifestations, especially the unimportant temperature changes; the local enlargement, which in the case of fingers is sometimes very great before actual suffering is induced; coupled with the family history of tuberculosis, usually facilitate recognition of the true nature of the affection.

Etiology and Pathology.—Heredity is an important feature of these cases, tuberculosis being usually traceable several generations back. In many cases of bone tuberculosis the lungs are primarily affected: a source of direct infection. Tubercular foci may form in any part of the bone, but particularly in the spongy portion. At first limited to the size of a pea, perhaps, it gradually enlarges; circuitous foci are then formed, which coalesce. Several general foci of infection may thus be formed all containing the bacillus of tuberculosis. The *detritus* may become transformed into a cheesy or liquid mass; if this does not occur, a sequestrum is formed, which sooner or later becomes

free in the cavity, surrounded by caseous pus. Nature tries to remedy the defect present by inclosing the cavity in sclerotic bone-tissue, and an ivory-like envelope may thus be formed around the tubercular cavity. In other cases a limiting pyogenic membrane is generated. Fistulous ulcers are developed from these cavities, the pus breaking its way outwardly.

Treatment.—In the early stages symptomatic treatment is indicated, the limb being immobilized in such a manner, however, as not to interfere with outdoor exercise whenever possible. Indeed, fresh air is an important therapeutic factor in all these cases, as is also nutritious food and other means calculated to strengthen the patient's general powers. The sea-shore, the mountains, and pine-forests are very beneficial—as instanced by Arcachon in France. Local treatment is sometimes very effective. The best of these consists of injections with a syringe into diseased areas of a 10-per-cent. solution of iodoform in oil, sterilized by heating to the boiling-point. But each agent should be sterilized separately; in this manner the toxic effects of the iodoform are avoided. Betanaphthol, 1 part; camphor, 3 parts; when finely powdered and mixed, form an oily liquid which may be dissolved in ether, chloroform, and fats; Reboul has used this remedy in various strengths in tuberculous cavities, with signal success. Some surgeons favor ignipuncture with galvanocautery or thermocautery.

Direct exposure to the rays of the sun is essential, and all hospitals should be provided with solaria or sun porches and roof gardens. Patients lying in bed should have the diseased joints exposed to the direct rays of the sun, their heads and eyes being protected by green glasses or shades. The joints may be covered

with blue, so as to secure easiest passage of the ultraviolet actinic rays, and local medications rich in iodine may also be employed as desired. Tent life on the hospital grounds, or, better, in the open pine forest, can be successfully employed through both summer and winter. Sanatoria should be established for tuberculosis of the hard tissues, as well as of the soft. The concentration of the sun's rays by lenses as suggested by Butler, Finsen, and others, is of positive benefit in bactericidal influence. As final curative agents, however, the direct sun's rays are most effective. Electrical rays can be used where sunlight is lacking. Willard (*Jour. Amer. Med. Assoc.*, July 18, 1903).

Operative measures consist mainly in exposing the affected area of bone and the use of the curette. This must be done thoroughly, however, every vestige of diseased bone or its contents being carefully removed. One small focus may serve for the development anew of all the symptoms. The same radical measures should be used in adjoining cavities or surfaces; no tuberculous centre should remain. The cavity should then be filled with iodoform-oil. Amputation used to be frequently resorted to in such cases; modern antiseptic methods have modified this tendency, and very few cases nowadays cannot be satisfactorily treated. Koch's tuberculin has been used with success by some, while others have reached opposite results with it. The measures indicated above are greatly to be preferred, and offer better chances of recovery.

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OVARIES. See UTERINE ADNEXA.

OXALIC ACID.—Oxalic acid is a caustic and corrosive poison obtained from cellulose. It occurs as transparent monoclinic crystals (resembling Epsom salts), having a strong acid taste. It is

soluble in water and in alcohol, and slowly soluble in ether. Of all the irritant vegetable poisons, oxalic acid is the most important. As it resembles Epsom salts (magnesium sulphate), it may be readily mistaken for it, and as it may be easily procured either as oxalic acid or as salt of sorrel or essential salt of lemon (potassium binoxalate) to remove ink-stains or iron-rust, to scour metals, to clean wood, or for use in photography, it is not infrequently taken by accident or with suicidal intent. Common sorrel (*oxalis acetosella*), containing oxalic acid in combination with potash (potassium binoxalate), is sometimes used in infusion as a cooling drink or as an ingredient of salads; but such use is not to be commended, as danger lurks therein. A fatal case of poisoning by the use of sorrel has been reported (*Hosp. Gaz.*, June, '86).

Oxalate of cerium is the only official preparation of oxalic acid; its description will be found under CERIUM.

Poisoning by Oxalic Acid.—When oxalic acid in substance or in strong solution is swallowed there is felt a hot, burning, acid taste during its passage downward, followed by pallor, clammy perspiration, violent prostration, intense abdominal pain, usually with vomiting. If the poison be diluted, the vomiting may last a long while. In some cases, however, vomiting is absent; in others it is incessant until death.

The mucous membrane of the mouth, tongue, and throat is whitened, appearing as though it were bleached. The nervous system appears to be also remotely affected, as, in cases of recovery from oxalic-acid poisoning, spasmodic twitchings of the facial muscles, temporary loss of voice, numbness, and tingling of the legs have been observed (*Henry C. Chapman*). It generally does

its work quickly and the corrosive symptoms are replaced by those of fatal collapse. When diluted sufficiently, so as to show no corrosive action, the acid is still highly poisonous, acting as a paralyzer of the heart (*Foster*). The minimum fatal dose, according to *Taylor*, is one drachm. Death may take place very quickly or may be delayed for several days.

Case of a man who, with suicidal intent, took a considerable quantity of oxalic acid. He died within ten minutes. The mucous membrane of the œsophagus was eroded in the upper and lower portion. There was erosions of the mouth and of the cardiac portion of the stomach as well as the upper part of the small intestine. The kidneys were congested. The blood in the heart was uncoagulated, and so remained at the end of eight days. It could readily be made to coagulate by the addition of chloride of calcium. Examinations of the blood microscopically showed crystals of calcium oxalate. In the small intestine and the kidneys no calcium oxalate crystals were found. *R. Kobert* (*Centralb. f. Innere Med.*, Nov. 15, 1902).

Treatment of Poisoning by Oxalic Acid.—To be efficacious, the treatment should be prompt and assiduous. After evacuating the stomach by emetics and siphon or stomach-pump, chalk (calcium carbonate), magnesia, and plaster-scrapings from the wall should be given, well stirred in water. Alkalies and their carbonates should not be given, however, under any circumstances, as the salts formed would be as poisonous as the oxalic acid.

Case of oxalic-acid poisoning in a boy, aged 15 years. Seen 12 minutes after the poison had been swallowed, patient was unconscious, markedly pallid and clammy, and extremities cold. Radial pulse could not be felt. Pupils were fairly dilated. Jaw was fixed in tetanic spasm, and froth exuded from between the teeth.

One-tenth grain of apomorphine was injected hypodermically; a stomach siphon-tube was introduced after the jaws had been pressed apart, and a pint of warm water was placed in the stomach, but immediately expelled. Vomiting continued, and consciousness returned. The boy now was given $\frac{1}{2}$ ounce of powdered chalk, suspended in water, and this also was shortly ejected. Recovery proceeded under stimulation. The quantity of poison taken was upward of $2\frac{1}{2}$ drachms. F. J. Lorimer Hart (Lancet, Oct. 1, '98).

Therapeutics. — Poulet proposed the use of this drug in asthma, capillary bronchitis, and tuberculous bronchitis. In some cases where oxalic acid was given in $\frac{1}{2}$ -grain doses F. W. Talley observed that it caused nausea, gastralgia, and an eruption resembling urticaria. Talbot Jones has reported four cases in which acute articular rheumatism was apparently produced by prolonged contact with a solution containing oxalic acid.

Generally speaking, however, oxalic acid is more interesting on account of its effects as a toxic agent than as a remedial one.

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OXALURIA.

Definition.—Although, logically, the term oxaluria ought to be limited to an abnormal condition of the urine characterized by the presence of an increased amount of oxalic acid, ordinarily it is employed to signify the precipitation of a sediment of oxalate of lime by the urine, caused commonly by diminution of the acid phosphates and compatible even with very small percentages of oxalic acid in the urine.

Normally about 0.02 gramme of oxalic acid is excreted daily, but, as the oxalic acid contained in the aliments easily passes in the urine, that amount may

easily be increased by the ingestion of sorrel, spinach, etc. The crystals of oxalate of lime are pellucid octæders, soluble in muriatic acid, but not in acetic acid.

Etiology and Pathology.—The formation of a sediment of oxalate being held by many authors to be the result of abnormal metabolism, it was believed to be intimately connected with many symptoms of disease, especially of the nervous system. Prout, Golding-Bird, and Cantani mentioned as the symptoms of oxaluria general weakness, restlessness, headache, pain in the spine and in the abdomen, painful micturition, diminished sexual power, hypochondria, melancholia, etc. Later investigations have proved that the precipitation of oxalate may be compatible with perfect health, although it is often observed in disorders of the nervous system, of which it can, nevertheless, not be considered to be the cause. The only danger arising from the sedimentation of oxalate is that it may give rise to a calculus, and sometimes the presence of minute calculi will reveal itself by painful micturition.

The significance of oxaluria depends upon whether it appears in concentrated urine or in urine of low specific gravity. In the former instance its presence is probably due to decomposition of the urates, and consequently is of little significance, whereas in the latter, especially if the deposit is constantly present, it indicates a morbid defect.

The causes of oxaluria are not thoroughly understood. It may be readily induced by partaking of certain articles of food, such as gooseberries, tomatoes, or rhubarb, and some authorities even hold that oxaluria depends always upon the existence of oxalates in the diet. According to Bence-Jones, oxaluria is due to incomplete oxidation of the carbohydrate proximate principles of food. Hence the increased excretion of oxalate of lime in dyspeptic and nervous

troubles and in cases of glycosuria. The circumstance is recognized that oxaluria may persist in certain individuals, even when all articles of diet known to contain oxalic acid or its compounds in any form are avoided, whereas in other persons, even though they partake freely of diet known to be rich in oxalic acid, we fail to find any evidence of oxaluria. David Newman (Glasgow Med. Jour., Oct., 1901).

Treatment.—The treatment consists in the prohibition of such aliments as contain large quantities of oxalic acid (sorrel, spinach, rhubarb), in recommending a proper diet containing a fair portion of meat and thus augmenting the acidity of the urine, and in prescribing alkaline spring-waters in moderate doses in order to saturate the excessive acidity of the gastric juice often corresponding to a diminished acidity of the urine, and to dilute the urine and dissolve the salts contained in it.

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OX-GALL.—Ox-gall, *fel bovis* (U. S. P.), or *fel tauri* is the fresh bile of the ox (*Bos taurus*). It is green, or brownish-green, viscid liquid of disagreeable odor and bitter, nauseous taste. Crude ox-gall is not employed in medicine. Inspissated ox-gall occurs as a yellowish-green, thick extract of unpleasant odor and disagreeable bitter taste. Purified ox-gall (sodium choleate) occurs as a yellowish-white powder, which attracts moisture readily.

Doses and Preparations. — *Fel bovis* (crude ox-gall).

Fel bovis purificatum (purified ox-gall), 3 to 10 grains.

Therapeutics.—Ox-gall is used in habitual constipation, combined with other appropriate remedies, in intestinal dyspepsia, and in malnutrition from an inability to digest fats. It has been given in typhoid fever, when there is a

deficient secretion of bile. In enema it has been found useful as a solvent of hardened fecal masses in cases of fecal impaction.

Harley recommends ox-gall in 5-grain doses, in capsules, in jaundice.

Ox-gall has been used to expel lumbricoid worms.

OXYGEN.—Oxygen was discovered in 1774 by Scheele, in Sweden, and Priestley, in England, independently of each other, and described under the names of “empyreal air” and “dephlogisticated air.” The name oxygen was given to it by Lavoisier some time afterward. In the atmosphere oxygen exists in a free and uncombined state (20 to 23 per cent.) mixed with nitrogen. Oxygen-gas is tasteless, colorless, and odorless. It is heavier than air and eight times heavier than hydrogen. When liquefied under pressure, it has a bright, sky-blue color. Water is a combination of oxygen (8 parts) and hydrogen (1 part). Under certain conditions it appears under the allotropic forms of ozone and autozone.

Preparations.—For experimental purposes oxygen may be obtained by mixing finely-powdered black manganese oxide (1 part) and potassium chlorate (4 or 5 parts), heating the mixture in a flask or retort, and receiving the gas in an inverted jar over water. All the oxygen comes from the chlorate, the manganese remaining quite unaltered. Although the process is very simple, certain precautions should be observed if the gas be intended for inhalation. The manganese oxide should not contain any combustible matter, or an explosion will result; a small portion should be first heated in a metal cup, should there be any doubt of the purity of the manganese. The first portions of gas should be allowed to escape, as they are con-

taminated by the atmospheric air of the apparatus and a little chlorine. The gas as evolved should be passed through three or four wash-bottles containing water, and to the first of these should be added about $\frac{1}{2}$ per cent. of caustic potash (to absorb any free acid), to the second about $\frac{1}{2}$ per cent. of silver nitrate (to absorb any free chlorine). The last washings should be with pure water. The gas may then be collected in a suitable gasometer and kept for a short time, or in rubber bags if wanted for instant use. Oxygen is now made on a larger scale, commercially, directly from atmospheric air, and is sold at a very low rate, delivered in steel cylinders, generally compressed so that a cylinder containing one hundred to two hundred gallons is of a convenient size for handling. From these cylinders the gas is drawn off into a gasometer or rubber bag, for office use or for single administration.

A local oxygen emphysema of the areolar tissue is set up, but without evil result, and gas is gradually absorbed, though slowly. The possibility of wounding a vein seems to be its only danger. This may be readily prevented by applying a ligature to the upper part of the limb. W. Ewart (*Brit. Med. Jour.*, Oct. 13, 1900).

Therapeutics.—Oxygen—whose physiological action is too well known to warrant repetition—may be administered in medicine or surgical practice in various ways: by inhalation, either pure, mixed with atmospheric air, nitrous oxide, ether, chloroform, or other substance; by drinking oxygen-water; by local application of a stream of gas or in solution as oxygen-water, hydrogen dioxide, etc.

USES BY INHALATION.—Inhalations of oxygen-gas are, in a general way, indicated in conditions where there is a deficiency of oxygen, manifested by symptoms of asphyxia, dyspnoea, or dis-

turbed nutrition, or when there is some functional disturbance of or impediment to respiration.

We find inhalations of oxygen useful and curative in the second and third stages of pneumonia when there is present a deficient aëration of blood (cyanosis and dyspnoea), with consequent heart-distension. The pure gas may be used, but better results are obtained by diluting it with 10 per cent. of nitrous oxide. The inhalations may be applied at intervals as required, or it may be necessary to keep them up continuously until all danger is passed.

The results of oxygen in chlorosis are absolutely negative. In cardiac or pulmonary dyspnoea a slight benefit was observed, but this ceased when the inhalations were suspended. Oxygen is not to be compared with artificial respiration in syncope or morphine poisoning. In that of carbon monoxide, oxygen proved very useful, as also in aniline poisoning, and to antagonize the disturbances caused by rarefied air. E. Aron (*La Semaine Méd.*, No. 21, 1901).

Oxygen inhalations are also beneficial in advanced bronchitis, especially in old persons. In stenosis of the larynx, croup, diphtheria, emphysema, heart disease, and in œdema, or marked congestion of the lungs the dyspnoea is greatly relieved by oxygen inhalations. In cardiac asthma it has been shown that the condition of the heart-muscle and the aorta is of an active or predisposing cause. If the organic lesion be overlooked, and a good prognosis given, surprise may be occasioned by the sudden death of the patient from heart-failure. The accentuation of the second aortic sound is the most reliable sign. The dyspnoea and cyanosis of cardiac insufficiency, Heitler says, may be promptly relieved by the combined use of morphine and ether hypodermically, with inhalations of oxygen.

Catlin recommends oxygen as the remedy for profound shock, either from hæmorrhage or nervous strain. He has used it successfully in hæmorrhage at the sixth month of pregnancy followed by miscarriage, where the prostration was absolute, with shock and constant vomiting. He has also found oxygen inhalations of benefit in typhoid fever where the prostration was marked.

Oxygen inhalations are useful in the resuscitation of persons asphyxiated by coal-gas, sewer-gas, hydrogen sulphide, carbonic oxide and dioxide, and chloroform-vapor.

In simple anæmia and chlorosis, in pernicious anæmia, and also in leucæmia oxygen inhalations have been followed by great improvement.

As a stimulant inhalation and as a nervous sedative, inhalations of oxygen-gas (60 parts) mixed with nitrous-oxide gas (40 parts) are highly recommended.

The combination of oxygen-gas with nitrous oxide or with the vapors of ether or chloroform has been used for the purpose of overcoming the disadvantages of the latter remedies. Oxygen decreases the danger and obviates the untoward effects. When oxygen is used in combination with ether for general anæsthesia, we observed less vomiting, less pallor, and less post-operative depression. F. H. Markoe states that if anæsthesia be induced by oxygenated nitrous oxide, it can be most satisfactorily and safely prolonged with oxygenated ether (*Annals of Surg.*, Feb., '96). Robert Abbe concurs in the opinion of Markoe, and remarks that there is no question of a gain of oxidation during etherization by the combined use of oxygen and ether. The patient's complexion is pinker, the blood in the wound more arterial, the minute arteries seem to spurt more, but

the blood clots quickly, so that there is no greater hæmorrhage.

Conclusions as follows in regard to use of oxygen in connection with an anæsthetic: The longest term required to produce complete anæsthesia with ether and oxygen-gas (diluted) was 14 minutes; the shortest time with the same anæsthetic, 7 minutes. With pure oxygen, anæsthesia with ether requires from 20 to 25 minutes, and then it will sometimes require the giving of ether with a cone and dispensing with the oxygen-gas for 2 or 3 minutes. With chloroform and oxygen-gas (diluted) the results are far more satisfactory and anæsthetization is very rapid, usually requiring about 2 or 3 minutes. I. N. de Hart (*Boston Med. and Surg. Jour.*, Apr. 16, '96).

INTERNAL ADMINISTRATION.—Oxygen-water is made by charging cold distilled water with oxygen-gas under pressure. It is bottled in siphons (preferably) or other strong bottles, under a pressure of 150 to 200 pounds. When wanted for use it is drawn off by pressure from the siphon-lever, or if in bottles by means of a champagne-tap. A little nitrous-oxide gas, added to the water during the process of bottling, adds piquancy and increases its stimulating effects.

The use of oxygen-water is advised in chronic dyspepsia, and in headaches of digestive or neuralgic origin.

Constipation due to intestinal atony is relieved by draughts of oxygen-water, swallowed quickly.

In general systemic torpor 1 or 2 tumblerfuls of oxygen-water after meals will prove beneficial.

LOCAL USES.—Stoker (*Med. Press and Circ.*, April 17, '95) describes the local treatment of ulcers and wounds by the direct application of oxygen-gas. For this purpose he states that the oxygen may be diluted with pure air according to the requirements of each case.

It is not necessary that an absolute vacuum over the parts treated should be produced. An oral rubber receptacle or cup covers the part to be treated and the gas is supplied to it from a rubber bag by means of tubing. Pure oxygen causes a great deal of pain, but some patients can stand it well.

Attention called to the triple property possessed by oxygenated water of hastening the precipitation of fibrin, of exciting the smooth fibres, and of injuring the tissues but slightly or not at all. For these reasons it must be an excellent hæmostatic for external use. If, in a case of intra-uterine hæmorrhage due to fungous metritis or to interstitial fibroid, a tent covered with cotton dipped in oxygenated water at 12 volumes be introduced into the fundus, an abundant moss will be seen to form, becoming confluent at the external orifice, while the organ contracts on the tent and the hæmorrhage is immediately arrested. There is no pain nor modification of tissues, and the hæmostasis persists long enough to enable the anæmic patient to recover strength and to support a radical operation later on if necessary. Paul Petit (*Lyon Méd.*, Jan. 5, '96).

In oxygen we have an excellent body for combating surgical infections without at the same time injuring the cells. The author leads the gas directly over the raw surfaces and into the infected tissues, so as to bring about a continuous oxygenation. In the following affections a rapid cure was brought about: (1) Suppurative arthritis of the knee; the pus is evacuated by lateral incisions and the gas then passed through the joint. (2) Purulent and tuberculous peritonitis. (3) Empyema. (4) Gangrene with the formation of gas. (5) Furuncles, carbuncles, and anthrax. The gas is here frequently injected into the dead tissue and the surrounding induration. M. Thiriar (*Bull. d. l'Acad. Royal de Méd. de Belg.*, No. 6, 1903).

For the local uses of oxygen in solution see HYDROGEN DIOXIDE.

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OZONE.—There has always been considerable discussion concerning the nature of ozone, but the consensus of opinion is that it is an allotropic or modified form of oxygen. It was discovered in 1839 by Schönbein, of Basle, who noticed that dry oxygen, or atmospheric air, when exposed to the action of a series of electric sparks, emitted a peculiar and somewhat metallic odor, resembling that of phosphorus, chlorine, or sulphur. This odorous principle (electrified oxygen) he called ozone.

Ozone is a colorless gas, having a characteristic odor. It is insoluble in water (pure water will absorb about 8.81 per cent. of ozone, the larger part, however, being converted by the water into oxygen without the formation of hydrogen dioxide) and in solutions of acids or alkalis, but is absorbed by a solution of potassium iodide. It is soluble in oils, some of them taking up as much as 25 volumes per cent. It exerts an irritating action on the lungs when present in any great amount in the air. Ozone is decomposed into oxygen by heat, gradually at 212° F., and instantly at 554° F. with an increase of 50 per cent. in volume.

It is a powerful oxidizing agent, and possesses strong bleaching and disinfecting properties. It corrodes cork, rubber, and other organic substances, and rapidly oxidizes iron, copper, and even silver, when moist, as well as dry mercury and iodine. The absorption of ozone by these and other agents is not attended with any diminution of volume. Oxygen when ozonized diminishes in volume (in the proportion of 3 to 2, according to Soret); when the ozone is decomposed by a metal or other substance, one-third of it enters into combination, while the remaining two-thirds, which is set free as ordinary oxygen, occupies the same

bulk as the ozone itself. Ozone may be liquefied by cold and pressure (125 atmospheres), and in that state it has an intense-blue color. Liquid ozone boils at 222.8° to 286.2° F., and if inclosed in a glass tube changes to a blue gas, which again reverts to the liquid state upon being cooled.

Preparation and Distribution.—Ozone exists naturally, in moderate and variable quantities, in atmospheric air. It is formed during thunder-storms and by silent electrical discharges in the atmosphere. It is evolved during the process of evaporation of water, especially of salt water, and also a result of the respiration of plants, especially those belonging to the *Coniferae*. It is therefore found in Nature at the sea-shore; in forests, especially in the pine-woods; at the summits of mountains and of high towers. On the other hand, it is usually absent in crowded cities and where organic matter is undergoing slow oxidation, except after a thunder-storm. A great amount of ozone is formed in the mist rising from the cold ground, under a clear sky, on a calm autumn or winter day. Atmospheric ozone, according to Schönbein, is only generated in any considerable quantity when oxygen, moisture, and sunbeams combine, as exemplified and utilized in the bleaching of linens upon the lawn. According to the same authority, under the influence of light the green foliage of plants exhale both ozone and neutral oxygen, both of which are again taken up in part by the growing cells of the plant.

Ozone may be prepared artificially by oxidizing phosphorus in moist air; by the electrolytic decomposition of water; by the slow oxidation of ether, oil of turpentine, and other essential oils; and by the action of strong sulphuric acid upon a mixture of potassium permanganate

and oxalic acid; and also, as shown by A. Houzeau, by the action of strong sulphuric acid upon barium dioxide; and by subjecting a current of oxygen to the action of the static electrical current.

Although the production of ozone by means of static electricity was discovered in 1839, it was not until 1854 that ozone was obtained in any appreciable quantities by von Siemens. Andrews and Tait discovered that the silent electrical discharge between very fine points would yield the maximum of ozone; and that the intermittent discharge, accompanied by the emission of sparks, caused a considerable amount of ozone produced to be reconverted into ordinary oxygen as fast as it was formed. Von Siemens's apparatus consisted of a sort of Leyden jar, made by coating the interior of a long tube with tin-foil, and passing over this tube a second wider tube coated with tin-foil on its outer surfaces. Between the two tubes a current of dry oxygen is passed, which becomes electrified by induction, on connecting the inner and outer coating with the terminal wires of an induction-coil (Ruhmkorff coil) or with a Holtz static machine. By this means it is said that from 10 to 15 per cent. of the oxygen may be converted into ozone. Von Siemens and Halske have since improved the original apparatus in many ways.

Houzeau's apparatus consists of a glass tube containing within a stout platinum filament, and wrapped on the outside with a spiral of copper wire or other good conducting material. One of the rheophores of the induction-coil is connected with the platinum wire, the other with the copper spiral. A current of dry oxygen-gas is allowed to pass through the tube.

The quantity of ozone produced is increased by lowering the temperature,

about 50 per cent. of the oxygen being converted into ozone at -88° F. Based upon this principle, W. J. Morton devised an effective machine which is much improved in detail (N. Y. Med. Jour., June 23, 30, '94), the output of the machine being measured in milligrammes of ozone per minute, and the dosage regulated accordingly.

Tests for Ozone.—In the presence of potassium iodide and moisture ozone will cause the liberation of free iodine (one-third of its volume acting in this liberation and two-thirds escaping as oxygen). Based upon this, test-papers are prepared by immersing sheets of unsized (bibulous) paper into a solution of starch and potassium iodide; these sheets are dried and afterward cut into strips of convenient size. For use one of the strips is moistened and exposed; if ozone be present in the air, it will liberate free iodine, which in turn will act upon the starch, producing a blue color (iodide of starch).

Bibulous paper dipped into tincture of guaiac will turn blue upon exposure to ozone.

Moistened indigo test-papers are decolorized by ozone.

In applying these tests it should be remembered that most of the reagents react similarly to hydrogen dioxide and to ozone, and allowances should be made therefor.

Physiological Action.—The air contains about two parts of ozone in one million: a quantity thought sufficient to act as a stimulant to the respiratory tract. To the absence of ozone in the air has been attributed many ailments, especially neuroses such as hay fever and the "nervousness" of which women most frequently complain. The fact that such disorders seem to be improved after a thunder-storm has apparently sanctioned this view and led to the use of ozone

as a remedy. In concentrated form it causes, when inhaled, inflammation of the respiratory tract and coagulation of the blood in the superficial arteries, though it restores the fluidity of the blood outside of the body. The local effect is attributed to its destructive influence upon the epithelium of the respiratory tract and inhibition of its functions, besides interference with the discharge of carbon dioxide. The toxic effects thus brought about unfavorably affect general metabolism and cause depression of cardiac action.

Physiological action of the ozone preparations studied in a series of experiments on dogs. 1. When injected in the circulation in full strength,—i.e., 15 volumes per cent.,—they have a very destructive action upon the blood, thereby ultimately having the effect of reducing rather than of oxidizing agents for the tissues. 2. Acting through the stomach or intestine, they may similarly affect the blood, and in addition they destroy the gastric and intestinal mucous membrane. 3. Given in medicinal doses by the stomach, their only benefit, if any, consists purely in their local action in the alimentary canal, in possibly preventing abnormal fermentations. 4. If so used, care should be exercised, owing to the great variability in strength of different preparations. 5. Ozone is of no real value to the tissues, whether inhaled or drunk in fluid preparations, and it may be exceedingly harmful. W. G. Thompson (Med. Rec., Mar., '94).

Therapeutics.—Ozone is utilized in medicine and surgery in the forms of ozonized air obtained through the use of one of the various special electrical apparatuses or as furnished by Nature at the sea-shore, mountains, or in the pines; ozonized (?) water, prepared by charging distilled, sterilized water with ozone by means of special apparatus; or ozonized oil: oil saturated by passing ozone or ozonized oxygen through it.

Ozone is thought to be Nature's purifier, acting by active oxidation upon decaying, putrescent organic matters, and converting them into harmless products, such as nitrous and nitric acids, water, hydrogen dioxide, and carbon dioxide; but its chief value in medicine is derived from its deodorizing and disinfecting powers.

In diphtheria, croup, pertussis, variola, scarlet fever, cholera, and other infectious diseases ozone generated in the room is said to improve the condition of the patient and minimize the contagion. Vapors of turpentine, eucalyptus, and similar substances will furnish a certain amount of ozone. Ozone disinfection of rooms after occupancy by subjects having contagious diseases is, perhaps, more effectual than by other methods.

Personal experiments have demonstrated that dry ozone has no appreciable action on the vitality of these organisms; that prolonged exposure does not diminish the pathogenic virulence of bacillus tuberculosis (in sputum), bacillus mallei, or bacillus anthracis; that ozone passed through a fluid medium containing bacteria has bactericidal power; that any purifying action which ozone may have in the economy of nature is due to the direct chemical oxidation of putrescible matter, and that it does not in any way hinder the action

of bacteria, which latter are, indeed, in their own way, working toward the same end as the ozone itself in resolving dead organic matter to simple non-putrescible substance. Arthur Ransome and A. G. R. Foulerton (Public Health, July, 1901).

In cases of cachexia, anæmia, and malnutrition inhalations of ozonized air have been found beneficial. H. S. Norris, of New York, observed improvement in cases of phthisis, following the use of ozonized water, taken internally. Schmidt reports excellent results following parenchymatous injections of ozonized water in two cases of epithelioma. He considers that it may be useful also in sarcoma and tuberculous growths. He reports the successful use of ozone-water as a local application in diphtheria.

W. J. Morton and C. C. Rice, of New York, have employed ozone-gas locally in cases of atrophic rhinitis and pharyngitis sicca (the patient holding the breath after taking a deep inspiration) by allowing a current of ozonized air to pass into the nostrils through a tube, intermittently. Rice has used ozonized sweet oil (8.75 volumes per cent.) in ozæna; it thoroughly deodorized the nostrils.

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P

PALATE, DEFORMITIES OF. See PLASTIC SURGERY.

PALPEBRÆ, DISEASES OF THE.

Inflammation of the Eyelids. (See BLEPHARITIS, volume i.)

Injuries of the Eyelids.

The lids may be the seat of all kinds of injuries, and, on account of the looseness

of the skin over the overlying tissues, œdema and ecchymosis are usually present.

Abscesses of the lid give rise to a localized red swelling, associated with more or less œdema and hyperæmia of the entire lid and the conjunctiva lining it. Throbbing pain in the eye and head and some fever accompany its formation.

Abscess of the lid is usually the result of traumatism, but may be secondary to periostitis or caries of the margin of the orbit.

TREATMENT.—If there be a solution in the continuity of the lid, the edges of the wound should be carefully approximated with sutures and evaporating lotions, like dilute lead-water and laudanum, should be applied. Simple ecchymosis of the lids, usually designated as "black eye," should be treated with ice-compresses and lead-water and laudanum. When an abscess is present, hot fomentations are useful until fluctuation is detected. An incision should then be made into the abscess parallel to the muscle-fibres.

In contusions of the lids, if patient is seen early, treatment consists of cold compresses or cooling or evaporating lotions. If patient is seen later hot compresses and massage are indicated to hasten the disappearance of the discoloration. Cold compresses are to be applied continuously at first, but not by means of an ice-bag or a piece of ice wrapped in a handkerchief and applied directly to the swollen lids. Small compresses of lint or flannel, fourfold or sixfold, measuring one and one and one-half inches in diameter, are to be cooled upon a block of ice and then transferred to the lids. An exchange is made between the warm one on the lids and a cool one from the ice every minute or two. Care should be taken not to allow the cold compresses to cover the nose, since acute coryza may be caused. Cold compresses of this sort are to be applied during the first twenty-four hours, either continuously or every second or third hour for an hour at a time. The application of cooling and evaporating lotions are of service, though less potent than iced compresses. Such cooling lotions consist of:—

℞ Acidi borici, 2 drachms.
Spir. vini, 2 ounces.
Aquæ, q. s. ad 1 pint.

Or:—

℞ Tinct. arnicæ, 2 ounces.
Aquæ, q. s. ad 1 pint.

Both of these are to be applied cold, the compresses being wrung out of the boric acid or the arnica mixture and changed frequently. When the swelling has subsided and discoloration shows itself in a more pronounced manner, the lengthy duration of this stage can be cut short by hot applications and by massage. Flannel cloths are to be wrung out of hot water—as hot as can be borne—and allowed to lie upon the lids, being changed every minute or two; such applications are continued for an hour at a time, and applied three times a day, or oftener. When the skin is very sensitive, it is well to apply a little white vaselin or any variety of bland salve to the eyelids previous to the use of hot compresses, so as to prevent soreness and irritation of the skin. In using massage the area involved is smeared with the ointment of the yellow oxide of mercury or white vaselin, and then gentle massage is practiced for five or ten minutes at a time, or longer, several times a day. If it is particularly desired to cause a very rapid disappearance of the blood-stain, the hot compresses may be used continuously, and the massage for a number of hours. By these means the disfigurement may be almost, if not entirely, removed within twenty-four hours, or even sooner, after the subsidence of the swelling. C. H. May (Med. Rec.; Brit. Med. Jour., Oct. 22, '98).

Hordeolum (Stye).—Hordeolum is a circumscribed purulent inflammation situated at the follicle of an eyelash. At first there is a hard swelling, with more or less involvement of the entire lid. A yellow head soon caps the little tumor, and, if allowed to go on, this will break open and the contents be discharged. There is usually a feeling of great tension in the lid until the abscess is opened, and there may be slight febrile disturbance.

Hordeolum is found chiefly in the

young, especially in anæmic girls, where it is the expression of a constitutional disturbance. Habitual constipation has been assigned as a common source of the inflammation. Uncorrected ametropia is a frequent cause.

TREATMENT.—The inflammation may at times be aborted in the earliest stages by hot boric lotion, by massage with yellow oxide of mercury, by applications of silver nitrate, or by painting the swelling with collodion. If this fail, suppuration should be encouraged by hot applications, and a free incision be made as soon as pus is suspected. Sulphide of calcium internally is frequently of service.

Recurrence must be prevented by destroying the pus-producing fungus on which they depend. This may be accomplished by causing the patient to scrub the edges of the closed lids, the lids themselves, the brow, and all the neighboring skin with a solution of mercury bichloride of the strength of 1 to 1000. The solution should be freshly prepared each time, the scrubbing conscientiously practiced night and morning, and the treatment continued for at least two weeks. H. D. Bruns (N. Y. Med. Jour., Aug. 16, 1902).

Chalazion.—Chalazion is a hard swelling which forms in the lids in connection with a Meibomian gland. It varies in size from the head of a pin to a large pea. Suppuration may occur, and the viscid contents of the tumor be discharged on the conjunctival surface of the lid, or the growth may be wholly absorbed and disappear. As a rule, it causes but little pain; rarely at times, however, it takes an acute form, when the symptoms resemble those of hordeolum. Chalazion originates in a chronic inflammatory process in the connective tissue surrounding a Meibomian gland, especially where there is uncorrected ametropia. It usually occurs in adults.

TREATMENT may be either abortive or

radical. The former is rarely successful, but massage of the growth may be tried, using an ointment of yellow oxide of mercury or iodide of cadmium.

The radical plan consists in the removal of the growth by operation, either from the skin or conjunctival surfaces. If the tumor shows evidence of having broken down, it had better be removed from the latter surface. This is accomplished by means of a vertical incision into the growth with a sharp scalpel, after thorough cocainization of the conjunctiva, and the removal of the contents of the sac with a small curette or scoop especially constructed for this purpose. If, on the other hand, the growth be large and firm, and gives no evidence of having undergone degeneration, it is better to remove it from the skin-surface by means of a formal dissection. For this purpose it is customary to control the hæmorrhage by means of a clamp which includes the field of operation in its area, and to insert several stitches after the tumor has been excised. Care should be taken that all of the growth be removed to prevent recurrence.

Cutaneous Disorders of the Eyelids.

ECZEMA.—Eczema is one of the most frequent of palpebral affections; it is usually met with in children in its moist form (*crusta lactea*). It is generally secondary to phlyctenular conjunctivitis, and results from the continued irritation of the lids by the profuse lachrymation incident upon this form of conjunctivitis. A similar eruption is seen in adults, especially in the lower lid, when the lachrymation is secondary to lacrymal disease or catarrh of the conjunctiva.

Treatment.—Removal of the scabs with a warm solution of bicarbonate of potassium without provoking any bleeding is advisable. After the lids have been thoroughly dried, a solution of silver nitrate,

20 grains to the ounce, should be carefully applied to the raw surfaces. The lid should then be covered with an oxide-of-zinc ointment. Either the plain ointment may be employed or one consisting of equal parts of oxide of zinc and vaselin, to which 20 grains of calomel have been added.

Benzin and hydrogen peroxide are very serviceable in removing crusts and scales from the eyelids in cases of squamous blepharitis and syecosis. Besides these remedies, prolonged compresses soaked with mercury bichloride, 1 to 10,000, and applications of Pagenstecher's ointment are necessary. Epilation can, on the other hand, be avoided.

The technique is simple. The lids are everted and cleansed with a pledget of cotton made wet with the benzin or peroxide. The latter may be employed in the strength of $\frac{1}{4}$ to $\frac{1}{2}$ per cent., while benzin is used undiluted. Wolffberg (Woch. f. Therap. u. Hyg. des Auges, vii, No. 1, 1903).

HERPES-ZOSTER OPHTHALMICUS is an inflammatory affection of the skin, characterized by the formation of vesicles along the terminal expansions of the supra-orbital division of the fifth nerve, and sometimes its nasal branch, and more rarely the infra-orbital division of the same nerve as well. The vesicles are generally grouped together and have an inflamed base. At first they contain a limpid fluid, but this soon becomes clouded; the vesicles then dry up and form scabs, which fall off and leave deeply-pitted scars that persist during the remainder of life. As a rule, the appearance of the vesicles is preceded by severe neuralgic pain in the course of the affected nerve-branches, and there is some fever. The pain generally subsides with the efflorescence of the vesicles. The eyeball is sometimes implicated, either in the form of a keratitis, iritis, or iridocyclitis. I have noted the occurrence of the disease with acute glaucoma.

It usually occurs in the old and feeble, although it has been seen in young and healthy individuals.

Treatment is wholly symptomatic, and consists in sedative local applications of lead-water and laudanum, or in dusting rice-starch over the affected areas. Morphine should be administered internally for the relief of pain, and tonics should be directed toward building up the system. For the severe neuralgia which frequently remains after the subsidence of the inflammation, croton-choral hydrate, in doses from 5 to 10 grains every four hours, and the use of a mild galvanic current have been highly recommended. Any ocular involvement must be combated by the proper remedies.

Tumors of the Eyelids.

CARCINOMA of the eyelids takes the form of *rodent* or *Jacob's ulcer*, occurring in adults, and characterized by a slowly-progressive, but destructive, ulcerative process, by which the lids and the neighboring tissues are gradually consumed. The first appearance is that of a pimple, usually at the inner canthus, which becomes indurated and covered by a scab.

Treatment should consist in the early and complete removal of all the diseased tissue by dissection, followed in some cases by the application of chloride of zinc or even of the actual cautery.

XANTHELASMA.—Xanthelasma are yellowish or buff-colored *plaques*, which are occasionally found upon the eyelids. These patches are slightly raised above the surrounding skin, and are frequently semicircular in shape. They are often symmetrical, and have a predilection for the inner part of the upper lids. They are more common in women than in men, and occur in adult life as a result of hypertrophy of the sebaceous glands, with subsequent fatty degeneration of the subcutaneous connective tissue.

Treatment.—As these growths have no significance other than a cosmetic one, they should not be interfered with, save when they are large and disfiguring, in which event they may be removed by careful dissection.

MOLLUSCUM CONTAGIOSUM.—This consists in a white tumor, varying in size from the head of a pin to that of a pea, that forms in the skin of the lid. The disease begins in a sebaceous gland, and is found chiefly among badly-nourished children.

**PAPILLOMATA, SARCOMATA, AND EPI-
THELIOMATA** are all found on the lids, but, as they have no characteristics different from those which they possess elsewhere, do not require mention.

Syphilis of the Eyelids.

Primary sores are found on the margin of the lids, usually at the canthi. The first appearance is that of a pimple, which gradually breaks down into a depressed ulcer, with a characteristic induration of the base. The glands in front of the ear and at the angle of the jaw are almost always involved, and the usual constitutional signs of syphilis follow. The contagion is carried to the eye, as a rule, by the finger, though in some instances it has followed a kiss or the filthy custom, practiced in some communities, of attempting to dislodge foreign bodies from the eye by the tongue.

Rarer forms which occur in the secondary and tertiary stage of the disease consist in a marked induration and swelling of the entire lid, followed by ulceration of the margins of the lids and the loss of the cilia.

TREATMENT.—Chancres should be dusted with finely-powdered iodide of mercury, or application made to them by the black or yellow wash. General mercurial treatment should be employed as

soon as the diagnosis of syphilis is assured.

Neuroses of the Eyelids.

BLEPHAROSPASM is an involuntary contraction of the orbicularis palpebrarum, and may be either the result of irritation of the ophthalmic division of the fifth nerve by reflex action, as in disease of the cornea, etc., or it may be an essential spasm, occurring in eyes that are perfectly normal. A slight twitching in a few fibres of the muscle is not unusual in ametropia and may be made to disappear by the adjustment of the proper glasses.

Cases of blindness after phlyctenular spasm have occurred not infrequently. Laber suggested that they might be either reflex or the result of a forgetfulness of the use of the eyes. Hysteria does not appear to have been present in any case. Ordinarily, the children recover, learning to see exactly as does the newborn infant. The theory that they have forgotten the use of their eyes is, personally, not wholly accepted, it being believed that they avoid visual perception because previous to the palpebral spasm such visual perceptions were painful or at least unpleasant. Amaurosis following phlyctenular spasm is a disease that does not find a place in any of the classifications used to-day. Baas (Münch. med. Woch., Jan. 24, '99).

Treatment should aim at the cause. In severe cases hypodermic injections of morphine into the lids may be necessary, or even subcutaneous division of the nerve.

Ptosis is a drooping of the upper lid over the eyeball, with inability to raise the same. When not congenital, or the result of thickening of the lid from inflammation, it is due to paralysis of that branch of the third nerve which supplies the levator palpebræ superior. Ptosis is frequently associated with palsies of other muscles supplied by the third nerve, and when it is an isolated symptom suggests central disease.

TREATMENT.—If of recent origin, alteratives, such as mercury and potassium iodides, should be administered in high doses; if of long standing recourse must be had to operative procedure. That of Panas is preferred. This operation has for its object the securing of a connection between the lid and the frontalis muscle by means of a skin-flap. This flap is obtained by inserting a horn-spatula under the upper lid, and by making a horizontal incision about five millimetres above the margin of the lid through the skin and subcutaneous tissue; another incision, parallel to this and about one millimetre long, is made through the eyebrow, and is extended as far as the periosteum. Two incisions are then made at right angles to the first inferiorly, the flap of skin remaining between the two primary incisions is undermined, and the tongue of skin drawn up under the bridge and held in position there by sutures.

Lagophthalmos.—By this term is meant an inability to close the eyelids. It is either due to paralysis of the facial nerve or is the result of some condition within the orbit, or in the eyeball itself, which causes the globe to protrude between the lids. As a result of the exposure to which the cornea is subjected, it frequently ulcerates, and, unless proper procedures be inaugurated, the eye is lost.

TREATMENT.—If due to paralysis of the seventh nerve, the cornea should be protected by carefully bandaging the eye during sleep, and by cleansing the conjunctival *cul-de-sac* with frequent washings of boric-acid solution. The primary cause of the paralysis must also be treated, and galvanism and hypodermic injections of strychnine may be tried. If the degree of lagophthalmos be excessive, the bandage should be worn constantly, and at times tarsorrhaphy is necessitated.

This operation consists in uniting the margins of the lids by means of sutures after their skin has been removed from the ciliary border by a sharp knife.

Congenital Anomalies of the Eyelids.

Absence of a part of or all of an eyelid or of both eyelids has been noted, though very rarely. *Cleft eyelid*, or *coloboma* of the lid, has also been observed—usually in the upper lid. At times this deformity occurs on both sides.

EPICANTHUS.—This applies to the development of a broad fold of skin which extends from the inner border of the eyebrow to the side of the nose, its outer border being concave. This anomaly is usually associated with ptosis, or drooping of the upper lid over the globe.

Deformity of epicanthus associated with a deep depression over the root of the nose overcome by a canthoplasty followed by a plastic operation which removes the crescentic folds and elevates the bridge of the nose. After the performance of the first procedure, two parallel and vertical incisions, one centimetre apart, are made at each side of the median line over the nose. From the middle of each of these incisions a rectangular flap is cut toward the inner canthi. After the lateral flaps are freely loosened and the central bridge of skin over the nose dissected up, the former is passed under the latter and the stitches are introduced through the three superimposed layers. Noyes (N. Y. Eye and Ear Infirmary Reports, '94).

Acquired Anomalies of the Eyelids.

It sometimes happens after injury, and especially after burns, that the edges of the lids become united to each other. This condition is known as *ankyloblepharon*. If the adhesion occurs at the outer angle of the lids, *blepharophimosis* is said to be present.

SYMBLEPHARON is a union between the lid and the eyeball, and is generally the result of a burn or some severe inflammation of the conjunctiva which has pro-

duced great shrinkage of the conjunctiva and cicatricial changes in the lids. The band of union may be but a delicate process of connective tissue, or the lid may be held down to the globe by an extensive cicatrix.

Treatment.—If the band be but slight, it may be severed by ligature, but if the attachment be more extensive, transplantation of healthy skin into the *cul-de-sac* may be necessary (Teale's operation), or the procedure of Harlan may be adopted. This author frees the lid from the globe by careful dissection of the band of attachment, and then makes an incision through the whole thickness of the lid along the margin of the orbit. A thin flap is then obtained from the skin below the lid, which is turned upward, as on a hinge, so that its raw surface is brought into contact with the inner surface of the lid, while its smooth surface presents toward the globe. Blepharophimosis may be corrected by dividing the outer canthus by a sharp pair of scissors, or by uniting the conjunctiva and the skin-surface by sutures.

ECTROPION.—Ectropion, eversion of the eyelid, may be caused by traumatisms, especially burns, the cicatricial contractions drawing its tissues outwardly. Muscular or senile ectropion is seen in the aged, as a consequence of atrophy of the palpebral portion of the orbicularis and relaxation of the tissues.

Treatment.—In senile ectropion the deformity may usually be overcome by means of Snellen's sutures. This consists in burying a suture, which is entered at two points, one-third of an inch distant from each other, in the mucous surface of the lid, and passing deeply into the tissues between the skin and the mucous membrane. It is brought out upon the cheek, where the ends are tied over a piece of drainage-tube.

Very simple expedient for the correction of the deformity observed in cases of extreme non-cicatricial ectropion of the lower lid is as follows:—

The canaliculus is slit, and an incision made in the conjunctiva about one millimetre removed from the opening of the Meibomian ducts, this incision being carried the whole length of the palpebral aperture vertically through the conjunctiva and tarsus by means of a Graefe knife. From the middle portion of the tarsus the conjunctiva is then separated for a few millimetres, after which the tarsus is divided. Each free end is grasped in turn by means of a forceps, and dissected out to its extreme limits, care being taken not to excise any conjunctival tissue. Steven's tenotomy-scissors are the best used. A bandage is worn for a few days. The lid is massaged with vaselin, in an upward and inward direction. A. E. Prince (*Amer. Jour. of Ophth.*, vol. xv, No. 5, '98).

In cicatricial ectropion it is necessary to include in the incision the scar-tissue which has occasioned the eversion of the lid. If the cicatrix is small, Wharton Jones's operation will suffice. This consists in excising the cicatrix by means of a V-shaped incision. After the edges of the incision have been freely loosened from the sublying tissue they are approximated so as to form a Y. If the cicatrix be extensive, or if there has been much destruction of the skin of the lids and the neighboring tissues, transplantation of skin from neighboring or distant parts is necessary.

ENTROPION.—Inversion of the eyelid, the margin, its lids being rolled inward, may be *spasmodic*,—*i.e.*, due to overaction of the orbicularis through irritation from concomitant disorders, conjunctivitis, keratitis, etc., or to undue application of bandages after operation; and *organic*, due to injuries, burns, ulcers.

Treatment.—The spasmodic form may readily be corrected by excising a narrow strip of skin from the lid parallel with its

ciliary border. In organic entropion, on the other hand, it is necessary to include the tarsus in the operation, as this is usually distorted by the previous inflammation.

One of the best procedures for the cure of this deformity is that of Hotz. This is performed as follows: A transverse incision from canthus to canthus is made through skin and subjacent tissues, but, instead of being made near and parallel with the free border (as in the former methods), the incision is to follow the upper border of the tarsus. It therefore describes a slight curve beginning and ending at a point about two millimetres above the canthus, but being six to eight millimetres distant from the free border in the centre of the lid. While an assistant is holding the edges of the wound well separated, the surgeon lifts up with forceps and excises with scissors a narrow bundle of the muscular fibres which run transversely along the upper border of the tarsus. The sutures, which are to include nothing but the cutaneous wound borders and the upper border of the tarsus, are then inserted. The first suture is placed in the centre of the lid; the curved needle, armed with fine, black, aseptic silk, is passed through the lower wound border; there taken again in the needle-holder, it is boldly thrust through the upper border of the tarsus and returned through the tarso-orbital fascia just above this border; and finally it is carried through the upper wound border. One similar suture is placed at each side of the central one, and these three stitches are usually sufficient for to draw the skin of the eyelid up toward the upper border of the tarsus and establish a firm union between these parts. This artificial union produces a slight tension of the tarsal skin, which, however, is sufficient to relieve any ordinary degree of

entropion. But when the lids have been badly contracted—when the palpebral aperture has become unnaturally narrow or the free border of the lid has become entirely merged into the plane of the conjunctiva—these complicated cases require, in addition to the above operation, such surgical measures as canthotomy, the restoration of the free border either by grooving the tarsus or by grafting.

Caustic potash recommended in the treatment of senile entropion due to trachoma. Before cauterization the lid is soaked for ten or fifteen minutes in a strong solution of cocaine. The crayon of caustic is sharpened by rubbing on wet blotting-paper. The aim is to produce an eschar, three or four millimetres wide, extending the whole length of the tarsus parallel to the margin, but nowhere nearer to it than two millimetres. The lid being everted and put upon the stretch, the crayon is drawn back and forth along the line about four millimetres from the lid-border until the epidermis is destroyed and the tissues beneath begin to assume a brownish color. When the action of the caustic has extended sufficiently, it is checked by the application of an acid solution, as diluted vinegar. No dressing is necessary. S. Theobald (Trans. Amer. Ophthal. Soc., '98).

Distichiasis and Trichiasis.

While distichiasis refers to the growth of the cilia along the outer marginal portion of the eyelid, trichiasis means a misplacement of the eyelashes. Both conditions are usually associated with entropion, especially when this condition is the result of chronic inflammation of the border of the lids.

TREATMENT.—Epilation or removal of the cilia by forceps may be tried if the stray cilia be not too numerous. Electrol-ysis may also be used in similar cases. Usually, however, excision of the misplaced cilia with the corresponding portion of the margin of the lid is necessary. This may be accomplished by making a

V-shaped incision into the lid and by excising the flap so obtained, along with the truant cilia.

If the deformity be extensive, transplantation of the row of cilia is usually effected, and this is best accomplished by the Jaesche-Arlt operation. After a Knapp or a Snellin clamp has been applied to stop bleeding the lid is split in its whole length by a sharp knife; a second incision is then made through the skin of the lid about five millimetres from its free margin and running its entire length. A semilunar flap of skin is then removed from the lid by carrying a third incision in a curve the entire length of the second incision. The edges of this incision are approximated by sutures, and the cilia drawn upward away from the globe.

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PANCREAS, DISEASES OF THE.

Pancreatic Hæmorrhage and Acute Pancreatitis.

HÆMORRHAGE.—Hæmorrhage into the pancreas occurs occasionally from a crushing injury, or a blow on the abdomen, lacerating the gland. It may occur also from rupture of a diseased vessel. Chronic venous congestion caused by heart disease may lead to small, disseminated bleedings. A more interesting class, however, are rare, grave cases in which hæmorrhage occurs from unknown causes. Zenker in 1874 first brought this condition prominently into notice as a cause of sudden death, and later Draper and his Boston *confrères* directed the attention of the American profession to it. It may occur with or without inflammation of the gland, or there may be necrotic changes in it. In absence of inflammation the digestive action of the pancreatic juice has been

attributed as a cause. A nervous origin has been assigned to some cases in which foci of hæmorrhage in the lungs were also found.

The hæmorrhage may be limited to a part of the gland or it may infiltrate the whole gland and the retroperitoneal tissues, even rupturing into the lesser peritoneal cavity and filling it with blood.

ACUTE PANCREATITIS.—With pancreatic hæmorrhage there may be inflammation which not infrequently terminates in necrosis. Inflammation may, however, occur without hæmorrhage; it then tends rather to suppuration than gangrene. It occurs most frequently in males from 25 to 60 years of age; in 41 cases only 4 were females (Körta). I have reported a case in a male infant aged 9 months. Painful gastro-duodenal disturbances have preceded in many cases, the inflammation evidently extending back along the duct. It is thus probable that indulgence in alcohol plays a part in its production.

Case of sudden death from hæmorrhage into the pancreas. At the autopsy there was no evidence of any inflammation of the pancreas, which tends to show that, while there are many cases of hæmorrhagic pancreatitis, the inflammatory theory will not account for all pancreatic hæmorrhages. In this case it resembled a cerebral hæmorrhage, and was related to atheroma of the splenic artery. Duquoy (*Jour. des Praticiens*, Sept. 16, '99).

Of 40 cases found in literature, 25 occurred in males and 9 in females; the sex of rest is not mentioned. Death in most instances occurred in a few hours. In some of these the loss of blood did not amount to more than eight ounces, and such deaths were apparently due to shock. Anders (*Jour. Amer. Med. Assoc.*, Dec. 2, '99).

Symptoms.—In both pancreatic hæmorrhage and pancreatitis the onset is usually sudden, but may be preceded by

some uneasiness in the abdomen. Usually there is intense diffuse pain in the epigastrium; it may be constant or paroxysmal. Nausea and vomiting are early symptoms, increasing in severity, but without relief. The vomit consists of food and mucus chiefly, but may contain blood in various stages of disintegration. Marked prostration, or even collapse, soon follows, probably from injury to the solar plexus. The temperature is normal or subnormal in cases of hæmorrhage without inflammation, and may not be high in the inflammatory cases in which the fever may be preceded by chills. The abdomen usually becomes distended in the upper zone and there is tenderness in the epigastrium. A mass may be palpable in the situation of the pancreas. The bowels are usually constipated, but there may be diarrhœa.

Diagnosis.—Lesion of the pancreas is indicated by the sudden onset of violent pain in the epigastrium, with vomiting, and soon followed by collapse. In the course of some hours there is usually tenderness and swelling in the epigastrium, and, in the inflammatory cases, some fever. Perforating ulcer of the stomach or duodenum may be suspected, but can generally be excluded by a previous history of pain after food, and hæmorrhages, and the more general peritonitis that usually follows. Duodenal cases may present much difficulty, as perforation may occur without any previous history of pain or disturbed digestion. The symptoms develop suddenly and the pain and collapse may be as marked. Moreover, duodenal ulceration occurs chiefly in the same class as pancreatic disease; that is, in males over forty years old.

Irritant poisoning may be excluded by the history and the character of the vomit. Biliary colic is excluded by the

absence of collapse, a history of previous attacks, and jaundice is present, but its frequent absence must be kept in mind.

Intestinal obstruction is the condition most frequently suspected. The onset, however, is less sudden, the distension and tenderness are not confined to the epigastrium, and a tumor may be found at the seat of obstruction. Inflation of the colon may determine the seat of obstruction.

The symptoms of pancreatitis are as yet but vaguely distinguished from affections of the gall-bladder; indeed, when complicated with jaundice one cannot differentiate these conditions. It is, however, generally agreed that an extensive and rapid loss of weight is very significant, particularly in the presence of clay-colored stools. Glycosuria is a tolerably constant symptom, but it appears too late to be of any diagnostic value. Fat-necrosis is to be expected, although it is found only after operation; and, since it occurs in other conditions, is not pathognomonic. Lipuria has been cited as an aid in diagnosis, but recent researches show that but little of the accumulating fat passes by means of the urine. If the urine in a case of pancreatitis be tested with phenylhydrazin, singularly arranged yellow crystals appear very constantly.

Hæmorrhage, probably the direct result of the reduction of the calcium of the blood, may supervene at any moment, and cause death very suddenly. A. W. Mayo Robson (Med. News, May 18, 1901).

While as yet no diagnostic symptom of pancreatic disease is possessed, unless, indeed, further observation should confirm the possibility of the demonstration, in acute pancreatitis, of the fat-splitting ferment in the urine, yet clinical and pathological experience has taught certain combinations of symptoms which justify a diagnosis in various forms of pancreatic disease.

Acute pancreatitis should be recognized in many instances. The impor-

tance of an early recognition of those cases which go on to extensive necrosis and to suppurative parapancreatitis is easily appreciable. Chronic interstitial pancreatitis is to be suspected under the following conditions: 1. Instances in which glycosuria develops in an individual with chronic cholelithiasis. 2. In cases of glycosuria in association with cirrhosis of the liver. 3. In glycosuria in the course of hæmochromatosis. 4. In glycosuria following attacks suggestive of pancreatic colic.

Pancreatic lithiasis is recognizable only when calculi are found in the stools. Cysts of the pancreas are usually to be recognized on account of their location. Primary cancer of the pancreas is often latent. The presence of obstructive jaundice with distended gall-bladder and rapidly developing cachexia, in association with little or no hepatic enlargement, is suggestive of this affection. Fatty stools—in the absence of diarrhoea or jaundice—together with indications of interference with the digestion of albuminoids, are valuable confirmatory evidence of deficiency or absence of the pancreatic secretion. W. S. Thayer (Amer. Medicine, March 1, 1902).

Morbid Anatomy.—The gland is enlarged throughout or in some part, and infiltrated with blood, the color of which varies with the duration of hæmorrhage and the severity of inflammation. A section may show a variegated surface, with opaque white spots due to fat-necrosis. Extensive hæmorrhage may be found in the root of the mesentery in retroperitoneal tissue, and about the kidneys, especially the left. In these parts areas of necrosis of fatty tissue are often found. If gangrene results, the gland or part of it may be converted into a dark-gray mass, wholly or partly separated from its attachments and lying in the lesser peritoneal cavity or in the cavity of a large abscess. The surrounding peritoneal surfaces become covered with a fibrinous exudate. The sac of the lesser peritoneum may contain a large

quantity of dark, offensive fluid in which masses of necrotic fat may be found.

Perforation, with discharge of this exudate, may take place into the stomach or duodenum, and recovery follow.

In suppurative pancreatitis a single abscess or multiple abscesses may form, or there may be diffuse purulent infiltration of the surrounding tissues. Perforation into the stomach or duodenum may occur. Fat-necrosis is rare in these cases.

Septic thrombus of the splenic vein may form and lead to infection of the portal vein and multiple abscesses in the liver. The spleen is not usually much enlarged. The pleura and pericardium may become infected by extension of the inflammatory process through the diaphragm. Various bacteria, especially the colon bacillus, are found in the affected tissues.

The constancy of the presence of *fat-necrosis* in hæmorrhagic and necrotic pancreatitis is a striking feature of disease of the pancreas. The condition is rarely met with apart from affections of the pancreas. It has been produced experimentally by inserting pieces of pancreas beneath the skin or into the subperitoneal fat, and by experiments on the pancreas itself. The areas vary greatly in size, some being as small as a pin's head, others as large as a hen's egg. They are soft in consistence. Flexner has found a fat-splitting ferment in them; it disappears within a few days.

Pancreas examined in 75 cases. In 11 total necrosis of connective tissue was found, the protoplasm of the cells being homogeneous and the nuclei staining poorly or not at all; in 29 cases there was disseminated necrosis of the acini and connective tissues; in the remaining cases there was no necrosis. The necrosis is evidently one of autointoxication. Chiari (Zeit. f. Heilk., B. 16, p. 70, '96).

The best results of obtaining fat-necrosis were obtained after ligating the veins and lacerating the pancreas on cats and dogs. The necrosis varied in extent and size from that of a pin's head to that of a pea. Although it cannot be confirmed that steapsin was the direct cause of necrosis of the tissue, such an assumption is rendered highly probable by its constant occurrence in diseased areas and its absence from healthy fat and the nature of the pathological changes. The escape of the pancreatic secretions into the peripancreatic and parapancreatic tissues is the origin of the necrosis. This escape is chiefly the outcome of lesions of the pancreas, but also of disturbances in its circulation. The pancreas in case of fat-necrosis suffers in two ways: it undergoes necrosis in the same way as the adipose tissue, or it is invaded by new growth of connective tissue, not limited strictly to the field of necrosis. In this way small nodules characteristic of interstitial pancreatitis, with a loss of parenchyma, may be formed. Flexner (Jour. Exper. Med., July 1, '97).

Fat-necrosis appears in the fat on the surface of the pancreas and vicinity; similar nodules may be present in the fat of the peritoneum at points more remote, denominated disseminated or multiple fat-necrosis. Peritonitis is not usually present. Pancreas studied in 80 dead subjects, and fat-necrosis found in only 2. Pancreas of 100 hogs examined, and fat-necrosis found in the interlobular fat in 2. In some instances the fat-nodules were found sterile. The bacillus coli communis was oftenest present. H. U. Williams (Med. Record, July 10, '97).

Experimental work upon pancreatitis leads to the conviction that (1) hæmorrhage *per se* is a common condition in all forms of pancreatitis; (2) when it is excessive, it dominates the process; (3) it is usually more pronounced than the inflammatory lesions, and the two conditions may be separate and distinct in the same organ or parts of the organ; (4) fat-necrosis is due to perversion of the pancreatic secretion and the direct result of the action of the fat-splitting ferment. Owing to the severity of the

means used to provoke pancreatitis in experimental cases, it is not to be supposed that hæmorrhage would commonly occur independently of inflammation of the gland; and this is found to be the case. The distintegration of the pancreatic tissue is one of the results of free hæmorrhage. If, now, tendency of the pancreatic secretion to act upon the pancreas, as has been pointed out by Blume and by Chiari, is recalled, it follows that these injured foci might easily become the starting-points of another form of degeneration which would lead to necrosis of the gland and to reactive inflammation; that this dead tissue might then in turn form a favorable point for the location and multiplication of micro-organisms, whose presence would still further complicate the process. Simon Flexner (Univ. Med. Mag., Jan., 1901).

After reporting a case of acute pancreatitis and necrosis of fat-tissue, in which death followed nine days after laparotomy and drainage, the authors noted the previous existence of two attacks, presumably due to gall-stones; the extension of the fat-necrosis toward the left adrenal and kidney, emphasizing the value of posterior drainage in such cases; the possible importance of the destruction of the adrenal in producing the fatal issue; and, finally, the negative results of bacteriological examination in extensive necrosis of the pancreas and fat-tissue. G. H. Monks and D. D. Scannell (Boston Med. and Surg. Jour., Jan. 22, 1903).

Prognosis.—Severe cases are generally fatal, but many mild cases probably occur and recover. Death may be due to collapse and occur within a few days, or cases that recover from the shock may succumb to septicæmia some weeks later. Osler and Körte report cases of recovery after laparotomy, and Trafoyer one of recovery after sloughing of the pancreas and its discharge by the rectum. In a case of my own in which there were some premonitory epigastric pains and distress followed by extreme pain and collapse, there was accumulation of se-

rous exudate in the lesser peritoneal cavity. After its evacuation a cyst of the pancreas formed; recovery followed drainage.

Treatment.—This is purely symptomatic. The extreme pain and the collapse require the subcutaneous injection of morphine and the administration of stimulants by the stomach or rectum. In hæmorrhagic cases with a fatal collapse threatening, it may be justifiable to open the abdomen and relieve the pressure on the solar plexus, to which death is probably due, rather than to loss of blood. It is only by operation that existence of a remediable cause such as perforation can be excluded. In the inflammatory cases operation may be advisable as soon as an accumulation about the pancreas or in the lesser peritoneal cavity can be demonstrated. In the meantime the patient's strength should be sustained as far as possible by easily assimilable nourishment.

Mild cases of pancreatitis recover with and without operative intervention, but severe cases require early operation, since the primary hæmorrhage in itself leads to necrosis and disintegration of gland-tissue, and the hæmorrhage may be stopped and further necrosis, both of fat and gland-tissue, prevented by gauze packing and adequate drainage. Again, the patient is in far better condition to withstand an operation early in the disease than later, when weakened by supuration in the lesser peritoneal cavity and necrosis of much fat and gland-tissue. In some cases the primary shock is so severe, however, that an operation is out of the question. F. B. Lung (Boston Med. and Surg. Jour., Nov. 29, 1900).

Chronic Pancreatitis.

Symptoms.—The symptoms of chronic pancreatitis are those of digestive disturbance with epigastric distress, and are not distinctive of pancreatic disease. With atrophy of the gland diabetes not

infrequently occurs. Enlargement of the head may cause obstruction of the common bile-duct, with jaundice and distension of the gall-bladder.

The chronic form of inflammation of the pancreas may arise from local or general conditions. The local are the most common, and consist of extension of an inflammation having its origin in catarrh of the duodenum or bile-passages and extending along the pancreatic ducts to the gland-tissue, or it may originate in an obstruction of the pancreatic duct. Of the general causes syphilis and alcohol are most common, the latter acting probably by exciting catarrhal inflammation of the duct.

Pathology.—The whole gland may be affected or only a part of it, usually the head. This portion of the organ may be small and very hard from the fibrotic change, as is met with in some cases of diabetes. On the other hand, it may be so large as to form a palpable tumor; not infrequently the enlargement is confined to the head, which becomes so hard as to closely simulate carcinoma. The surface of the gland may be smooth or nodular, or even granular and of a grayish-white color. The duct may be normal or more or less irregularly dilated, especially if there has been obstruction of the duct.

The most frequent cause of chronic pancreatitis is obstruction of the duct of Wirsung, due to pancreatic calculi, to biliary calculi in the terminal part of the common bile-duct, or to carcinoma invading the head or body of the gland. Duct obstruction may be followed by the invasion of bacteria, which take part in the production of the resulting lesion.

Ascending infection of the unobstructed duct of Wirsung may follow an acute lesion of the duodenum or of the bile-passages, and may cause chronic inflammation. In cases which have given a history of long-persistent vomiting,

chronic diffuse pancreatitis may be found at autopsy, and is probably the result of an ascending infection of the gland. General or local tuberculosis is occasionally accompanied by chronic diffuse pancreatitis, affecting chiefly the interstitial tissue of the gland. Chronic interstitial pancreatitis is not infrequently dependent upon the same etiological factors, notably alcohol, which produce cirrhosis of the liver, and in about one-fourth of the cases the two lesions are associated.

Following duct-obstruction and ascending infection the lesion affects principally the interlobular tissue, only secondarily invading the lobular tissue and sparing the islands of Langerhans. Diabetes results only when the lesion is far advanced. Accompanying the so-called atrophic or Laennec's cirrhosis of the liver, the pancreas is at times the seat of a diffuse chronic inflammation, characterized by diffuse proliferation of the interacinar tissue, which invades the islands of Langerhans. A similar lesion accompanies hyaline degeneration of the islands of Langerhans and the condition known as hæmochromatosis. Interacinar pancreatitis is usually accompanied by diabetes mellitus. When diabetes is absent the lesion is of such slight intensity that the islands of Langerhans are little implicated. E. L. Opie (*Amer. Jour. Med. Sciences*, May, 1902).

Treatment.—The treatment is essentially dietetic, the aim being to reduce the quantity of articles of food requiring the pancreatic ferment for their conversion. Hence the consumption of fats and starches should be restricted. Minced animal pancreas has been used by Abelman with success; pancreatin (*q. v.*) is a more convenient remedy. Small doses of bicarbonate of soda, twenty minutes after meals, tend to allay the local pain.

In chronic interstitial pancreatitis operation advocated at the earliest possible moment. To attack the head of the pan-

creas or the pancreatic duct a vertical incision should be made through the right rectus, and not in the middle line. When deep jaundice is present, calcium chloride in 20-grain doses should be given three times daily for twenty-four or forty-eight hours before operation and in the form of an enema for twenty-four hours afterward in 60-grain doses thrice daily. Of 17 patients operated upon, 16 recovered, while, in cancer of the pancreas in 16 patients operated upon, only 9 recovered from the operation, the ultimate duration of life thereafter being very brief. A. W. Mayo Robson (*Lancet*, July 28, 1900).

The writer opposes the published statement of Robson and Moynihan that "chronic pancreatitis must be treated by abdominal section and drainage—obtained by draining the gall bladder," and believes that many unnecessary operations have been done. As a proof of recovery without operation he reports a case of his own where the diagnosis was confirmed by exploratory incision, but no operation performed on the organ. A search of the autopsy records in Guy's Hospital for a period of forty years has also convinced him that chronic pancreatitis is rarely a fatal disease. W. H. White (*Brit. Med. Jour.*, July 18, 1903).

Cysts of the Pancreas.

Symptoms.—The symptoms are indefinite. The onset may be with the symptoms of acute pancreatitis, or only with disturbance of digestion and epigastric discomfort. The attention may first be arrested by the discovery of a tumor, which may grow rapidly; in chronic cases it usually develops slowly. It may be subject to rapid enlargement from time to time, possibly on account of hæmorrhage. The tumor is usually smooth and rounded, lying chiefly to the left of the middle line of the body. It is only slightly movable and is not affected by respiration. It may transmit the aortic impulse, but it is not expansible. In large cysts fluctuation can

sometimes be elicited. The cyst may grow until it distends the whole abdomen, extending from the ensiform cartilage to the pubes. It projects into the left lumbar region, rendering it flat to percussion and resistant. By its pressure it may interfere with respiration and disturb digestion. Sugar is present in the urine of some cases.

Diagnosis.—The diagnosis is usually only probable. The position of the tumor, its relation to the stomach and colon which can be determined by inflation of these organs, its general characters, and the history of its development, usually indicate its pancreatic origin. Even after exploratory puncture the nature of the cyst may remain uncertain, as the contents may have lost the digestive ferments, and these may be present in cysts communicating with the pancreas. A persistent discharging sinus is in favor of a pancreatic cyst.

Hydronephrosis, especially of the left kidney, and dropsy of the gall-bladder have to be excluded, as has also a large ovarian cyst. Distension of the lesser peritoneal cavity is often indistinguishable from pancreatic cyst. As a rule, the contents consist of serous fluid, do not contain the digestive ferments, and do not reaccumulate after evacuation.

The following common symptoms are of value in making the diagnosis of cysts of the pancreas: (1) gastric symptoms, pain, tenderness, vomiting, signs of dilatation, etc.; (2) emaciation; (3) their development in the epigastrium, generally somewhat to the left side; (4) their situation near the posterior abdominal wall, upon the aorta, so that its pulsation is seen and felt; (5) their immobility; (6) the stomach (dilated) and the transverse colon are found lying upon the cysts. Pancreatic symptoms were absent in four personal cases, one of which died. G. Seefisch (*Deutsche Zeit. f. Chir.*, March, 1901).

Etiology.—Cysts probably form in the

pancreas most frequently from obstruction of the duct or one of its branches; they may arise also from circumscribed collections of fluid in the substance of the gland. Many supposed cysts of the pancreas doubtless form wholly outside the gland.

They occur equally in both sexes and usually in adult life, but are met with occasionally in young children. The largest group of cases results from inflammation of the gland or the duct. The tumor may develop rapidly, or may not appear for some weeks or even a year or two.

A second group of cases follow traumatic injury of the abdomen. Of 33 cases collected by Körte, 30 were in males. Probably many of them were due to accumulation of fluid in the lesser peritoneal cavity or to cystic formation in the vicinity of the gland. Doubtless some of them were due to inflammation of the gland or duct, causing occlusion of the latter and retention of secretion as in the first group. Some of them may have originated from hæmorrhage into the pancreas.

In a third group there is no history of injury or of inflammation. These are met with in women especially, and run a very protracted course: some years usually.

Pancreatic cysts generally project forward between the stomach and transverse colon. In some cases, however, it appears above, the stomach pushing it downward, and in rare cases it develops low down in the abdomen, both stomach and transverse colon lying above the tumor. They are usually in the middle line of the body, but may lie to the left, near the spleen if developed from the tail of the pancreas.

The contents of cysts vary in character. Probably in smaller cysts the fluid

is dark brown and contains blood or blood-pigment, fat-granules, degenerated epithelial cells, and, it may be, cholesterin. Large cysts are older and the contents are usually grayish, of alkaline reaction, and from 1010 to 1024 specific gravity. The fluid may not only emulsify fat and convert starch into glucose, but also digest albumin and fibrin. The last only is distinctive of the pancreatic origin of the fluid, as the contents of other cysts may possess diastatic and emulsifying power. It is also important to note that the fluid of pancreatic cysts in time loses digestive power.

Treatment. — The smaller pancreatic cysts accidentally discovered call for no treatment. Large cysts require surgical intervention, removal when possible; but drainage is all that can be effected in most cases. Either method is usually successful; however, a fistula may remain open even for years in cases of drainage.

The treatment for cysts of the pancreas consists in incision and drainage, or extirpation. The incision should usually be in the median line of the abdomen, exceptionally over the most prominent part of the tumor. It is well to attach the cyst wall to the abdominal wall or to the parietal peritoneum before incising it. After emptying the cyst and irrigating its cavity with saline solution, a large glass drainage tube should be introduced to the bottom of the cavity and surrounded by sterilized gauze. If the cyst is not extirpated, another tumor may subsequently develop. If drainage is resorted to, a fistula may result, which may give rise to various complications, but in most cases the fistula will eventually heal. C. G. Cumston (*Revue de Chirurgie*, June 10, 1903).

Tumors of the Pancreas.

Of the tumors of the pancreas, cancer is by far the most frequent and important. The head is the usual seat, rarely

the body and tail. The cancer is usually of the scirrhus variety, but cases of soft and of colloid growths are occasionally met with. Wirsung's duct is often obstructed and not infrequently the common bile-duct also, causing intense and persistent jaundice. By the size of the tumor or on account of implication of the wall of the intestine, it may cause obstruction of the duodenum. It occurs most frequently between the ages of 30 and 50, but may be met with at any age, even in infancy. Unlike cancer of the gall-bladder, it rarely occurs with calculi. It is usually primary, but the pancreas may be the seat of secondary metastatic tumors when the disease becomes generalized. Carcinoma of the stomach or duodenum rarely extends to the pancreas.

Pancreas examined post-mortem in one hundred cases for fat-necrosis, but found none. The only disease discovered was carcinoma, and in one or two of these the gross appearance was that of fat-necrosis, but the microscope showed cancer. Blaisbrook (*Med. Record*, July 10, '97).

The symptoms are very indefinite and rarely sufficiently distinctive to render a diagnosis possible. There is not rarely a long history of disturbed digestion. Of the disease itself there may be such suggestive symptoms as epigastric pain from time to time, loss of flesh and vigor, the presence of a tremor in the epigastrium, the occurrence of jaundice with enlargement of the gall-bladder, and ascites from pressure on the portal vein. Such symptoms are present only in a minority of cases. There may be glycosuria, and undigested meat-fibres may appear in the stools. The most important evidence consists in the presence of a fixed tumor, the occurrence of extreme and persistent jaundice, an enlarged gall-

bladder, and the development of cachexia and emaciation.

When a patient suffers from deeply-seated pain in the epigastric or hepatic region, with progressive emaciation, but without signs definitely indicating gastric cancer, with jaundice and dilatation of the gall-bladder, without a history of biliary colic, by far the most probable diagnosis is primary cancer of the pancreas. This diagnosis is not much affected by the state of the liver, which may be large or small and may or may not contain palpable cancerous growths. If the gall-bladder is not dilated the diagnosis must remain uncertain. These views are based on the post-mortem examination of seventeen cases. W. P. Herringham (St. Bartholomew's Hosp. Reports, London, vol. xxx, p. 5, '94).

In an inoperable case of carcinoma of the pancreas the effect of pancreatic juice upon the absorption of fat was studied. When the patient was on a milk diet, a decidedly excessive quantity of the ingested fat was lost, or, in other words, fat-absorption was distinctly impaired. The fat-splitting process was accomplished as fully as in health, probably by micro-organisms, as it was shown that the bacterial activity of the intestine was more pronounced than in health. The putrefaction of proteids in the intestine was excessive. W. P. Northrup and C. A. Herter (Amer. Jour. Med. Sci., Feb., '99).

Conclusions that when cancer of the pancreas is surely diagnosed operative treatment is either useless or harmful; when the diagnosis is doubtful, especially in young or middle-aged subjects, exploratory operation should be seriously considered, since much may be hoped from surgical treatment in inflammatory conditions. A. W. Mayo Robson (Lancet, July 28, 1900).

The outlook is, of course, hopeless, death occurring usually within a few weeks after the occurrence of the more grave symptoms.

Of other tumors, sarcoma, lymphoma, adenoma, and gumma are occasionally met with; syphilis more often causes

diffuse interstitial infiltration. Miliary tubercle is not rare.

In a study of 128 cases of tuberculosis the pancreas was found tuberculous in 13, or in 9.37 per cent. The pancreatic disease seems to be always secondary, either by extension from neighboring organs or hæmatogenous in miliary tuberculosis. Sex plays no rôle; age, on the contrary, is an important factor, 44.44 per cent. of the bodies of children examined presenting tuberculosis of the pancreas. Kudrewetski (Zeits. f. Heilk., B. 13, H. 2, 3, '93).

Pancreatic Calculi.—Concretions are sometimes met with in the pancreatic duct similar to those occurring in the salivary glands. They are usually small, like grains of sand, but may be as large as a walnut. They are usually multiple. They are generally round, and grayish white in color, and composed chiefly of carbonate of lime with some phosphate. Cholesterin is reported present in some cases. They occur in dilated ducts or may be the cause of obstruction and dilatation of the ducts. They may excite chronic interstitial inflammation of the gland or acute suppurative inflammation.

Efficient cause of pancreatic calculus believed to be chemical alteration of pancreatic secretion, due, in most cases, to the action of microbes. Mere retention of secretion, although a predisposing condition, is not an efficient cause, for CaCO_3 predominates in pancreatic calculi, whereas it is not present in the normal secretion. Calculus appears not uncommonly in connection with diabetes (22 times in 225 cases). It is more common in men than women (19 men, 7 women), and chiefly attacks people of late middle life. Giudiceandra (Il Policlinico, Mar. 15, '96).

The symptoms at best are very indefinite. There is usually a preceding history of gastro-duodenal indigestion. The stone in its passage or incarceration may cause symptoms identical with those

of gall-stone colic even to the jaundice, which, however, may be absent in both. Following the paroxysms of pain, calculi may be found in the stools, while, sometimes, transient glycosuria follows the attacks of colic. There may be symptoms of acute or chronic pancreatitis and cyst of the pancreas may form. There may be much muscle-fibre in the stools, which may also be fatty. The patient may lose flesh and strength.

The diagnosis can only be surmised, unless calculi are found in the stools.

The treatment is similar to that for biliary colic. Good results are reported from the hypodermic injection of 1 cubic centimetre of a 1-per-cent. solution of pilocarpine, three times a week.

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PANCREATIN.—Pancreatin (pancreatinum, U. S. P.; extract of pancreas, pancreatic extract) is a mixture of the enzymes existing in the pancreas of warm-blooded animals, usually obtained from the fresh pancreas of the hog. Pancreatin occurs as dry, whitish or yellowish-white, brittle scales, or oftener as a yellowish-white, amorphous powder without odor, or having a peculiar odor and a faint, meat-like taste. It is almost completely soluble in water, insoluble in alcohol, soluble in dilute alcohol, and is precipitated from solution by alcohol in excess. It is not an artificial compound. It should be absolutely free from all added substances and contain the ferments as they are naturally associated in the pancreatic glands. Five ferments are to be found in pancreatin: trypsin, which converts albumins, or proteids (of milk, beef, fish, blood, etc.), into peptone in either neutral, alkaline, or slightly acid media; diastase, or amylopsin, which resembles ptyalin very

closely and converts starches into dextrin and sugar; an emulsive ferment which emulsifies the fats; steapsin, which splits fats into glycerin and fatty acids; and, finally, a milk-curdling ferment.

Extemporaneous Preparation.—An active preparation may be prepared as follows: The fresh pancreas of a pig, killed about six hours after a full meal, is chopped fine and to it is added four times its weight of dilute alcohol. After standing for twelve hours pour off the liquid portion and filter it. The liquid may be given in doses of 1 to 2 tablespoonfuls. Another method, given by Hare, is as follows: Wash and chop up fine a fresh pancreas, and allow it to soak in alcohol for twenty-four to forty-eight hours. After this squeeze out the alcohol and add to the pancreas 10 times its weight of glycerin. Allow it to stand for forty-eight hours and then filter. This may be given in doses of 30 drops in a glass of milk. The solutions or liquid extracts from the pancreas are, however, objectionable and inferior to the dry pancreatin, principally because of the tendency of these solutions to precipitate and to undergo deterioration owing to the large amount of organic matter present. The diastasic power especially is variable and weak, and tends constantly to diminish. Furthermore, these solutions impart their peculiar, repulsive taste to foods, milk, and gruel, etc. For these reasons it is always best to use a dry extract of pancreas (pancreatin).

Physiological Action and Tests for Pancreatin.—The value of a pancreatic preparation depends upon its digestive activity and upon the quality of the resulting digested product. A pancreatic extract may peptonize milk perfectly, but the peptonized milk may be unfit for food, owing to the development of rancid fatty acids, giving the milk a peculiar,

sour, repulsive odor. A good pancreatin should rapidly digest milk, beef, fibrin, and all forms of starchy food. It should convert the casein of milk into peptone without the development of any rancid flavor. The action upon casein may be taken as a satisfactory test of the proteolytic power of any pancreatin. The activity of a pancreatic preparation upon a proteid may be tested as follows: Place into a flask or bottle 15 grains of sodium bicarbonate, add 5 grains of dry pancreatic extract, or pancreatin; mix well and add 1 pint of milk warmed to 130° F. Shake well and place the bottle conveniently for observation. At first there should be no odor or taste imparted to the milk. In a few minutes the milk will become of a slightly grayish-yellow color which in ten minutes will be more marked, somewhat thinner, and of a distinctly-bitter taste, due to the conversion of the casein. This taste is a pure bitter without suggestion of rancidity. For purpose of comparison, a second flask of milk mixed with the soda and water without the pancreatin may be prepared. By withdrawing a small portion of the milk from time to time and adding a few drops of acetic acid, the conversion of the casein may be tested by the character of the curd formed—from the tough casein, to the light, flocculent precipitate, and the final, slight, scarcely perceptible, granular coaguli. The diastasic power of a pancreatic preparation may be tested as follows: Mix 1 drachm of arrowroot or starch with 5 fluidounces of cold water, and boil well. To a fluid-ounce of this thick starch (at 110° F.) add a grain or two of pancreatin, or dry pancreatic extract, or a few drops of a fluid product, and stir well. The starch should almost instantly become thin and fluid, like water, showing the formation of soluble starch, which is gradually con-

verted into dextrin and glucose. A product which does not quickly liquefy thick, warm starch-jelly is worthless as a diastasic agent. (Fairchild's "Hand-book of the Digestive Ferments.")

Therapeutics. — Pancreatin is extensively used in the preparation of pre-digested or peptonized foods. It acts best in an alkaline medium, although the use of an alkali is not essential to the action of the pancreatic ferments. To peptonize food is to digest food artificially, to submit it to the action of the digestive ferments, whereby changes are effected precisely similar to those which in the living body are essential before it can be absorbed. Flesh and starch foods are incapable of being absorbed until by the action of the digestive juices they have become soluble. Pepsin is not available for household use in artificially digesting food of any kind. Peptonized food is, therefore, not food prepared with pepsin, or necessarily containing a ferment of any kind; it is digested food. The pancreatic ferments are capable of digesting every known form of food. The peptonizing action is most energetic at about the heat of the body, slow at the temperature of a room (60° to 70° F.); at a lower temperature, even at freezing, the peptonizing agent is not destroyed, but is simply inactive; at the boiling-point (212° F.) it is at once destroyed. Peptonized foods are valuable in all cases where the digestive functions are impaired, during the course of acute fevers, and in chronic wasting diseases. They also fill a useful office during the period of convalescence from acute and exhausting diseases. They are therefore valuable in typhoid fever, gastric ulcer, acute dysentery, chronic diarrhoea, gastric catarrh, pneumonia, tuberculosis, and diabetes. For infants, peptonized milk or milk prepared by Fairchild's peptogenic

milk-powder or by means of Fairchild's extractum pancreatis or peptonizing tubes, is a valuable substitute for mothers' milk. When rectal alimentation is rendered necessary either from inability to swallow or from inability of the stomach to retain or digest food, peptonized nutritive enemata become of inestimable value. These may be composed of milk alone or with egg, of egg-albumin, or of beef peptonized before being used.

DIGESTIVE DISORDERS.—Pancreatin, in doses of 3 to 10 grains in capsule, given about two hours after meals, and preceded by 10 or 15 grains of sodium bicarbonate, will assist insufficient salivary and intestinal digestion. It is also beneficial in lenteric diarrhœa. In diabetes mellitus dependent upon a lesion of the pancreatic gland (carcinoma or atrophy) the use of pancreatin and of peptonized foods are strongly indicated.

DIPHTHERIA.—In diphtheria pancreatin has been used in spray and powder for the purpose of destroying the false membrane and favoring its expulsion. It is usually combined with sodium bicarbonate (3 parts to 1 of soda) for insufflation as a powder; or 15 grains of pancreatin and 5 grains of sodium bicarbonate, with a drachm of glycerin in 1 ounce of water may be used as a spray. The latter should be prepared fresh every few hours. Samuel Johnson has suggested (*Jour. Amer. Med. Assoc.*, July 29, '93) the addition of $\frac{1}{4}$ grain of corrosive sublimate. Better as a solvent for diphtheritic membrane is the use of trypsin, as it presents the proteolytic ferment of the pancreas in the most active form. Trypsin may be applied by insufflation, pure or mixed with sodium bicarbonate—4 grains of trypsin to 1 grain of soda; it may be applied on a moistened brush or probe covered with absorbent cotton; or mixed with water

and sprayed: trypsin, 15 grains; sodium bicarbonate, 5 grains; water, 1 ounce; to be prepared fresh every few hours, or chloroform or pure creasote, 4 drops, may be added as a preservative.

SURGICAL SOLVENT.—The proteolytic action of pancreatin has been utilized in the treatment of urethral and œsophageal strictures, for dissolving sloughing tissue, coagulated blood, and muco-pus. C. D. Jones, of Brooklyn, has used pancreatin or pancreatic extract for cleaning out ulcerous cavities in a case of hip-joint disease. A solution of 1 drachm to the gill of water was poured into an abscess-cavity, remaining one week after an excision, and left in place a half-hour. Upon irrigating, numerous shreds of broken-down ligamentous tissue and many spicula of dead bone that had become imbedded in the soft tissue and that had previously escaped both irrigator and curette were washed out. In hæmorrhage of the bladder, with the formation of clots, pancreatic extract in solution, with or without soda, may be used to dissolve the coagula.

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PARALDEHYDE.—Paraldehyde (paraldehydum, U. S. P.) is a polymeric form of ethylic aldehyde. It occurs as a colorless liquid (crystallizes below 50.9° F.), having a peculiar, aromatic, suffocating odor and warm taste. It is soluble in alcohol, ether, oils, and chloroform, and in 8 to 10 parts of cold water, but less readily in hot water. When small bulk is desired, it may be given in an equal volume of oil of sweet almonds. The dose is 30 to 90 minims in capsules, or well diluted with simple elixir, sweetened water, brandy, or rum.

Physiological Action.—The weight of evidence tends to sustain the views of

Gordon, who in a series of experiments found that paraldehyde was mainly eliminated by the lungs, being readily detected in the breath six or eight hours after its ingestion. In the urine it can also be recognized three or four hours after ingestion. The drug markedly increases the elimination of urea, accompanied, however, by increase of the watery constituents. Small doses produced no fall of arterial pressure in cats and rabbits, but large doses caused a considerable fall. In man it also lowers heart-pressure. Injected intravenously it soon caused death through heart-depression, after a gradual increase of the pulsations. Paraldehyde depresses reflex action and reduces muscular tetany.

Poisoning by Paraldehyde.—Thomas MacKenzie, of Douglass, England, records (*Brit. Med. Jour.*, Dec. 12, '91) a case of poisoning by paraldehyde, in a woman who took $3\frac{1}{3}$ ounces. Several hours after the drug was taken she was found in a deep stupor and limp, like one under the influence of chloroform, with a strong odor of the drug on her breath, face slightly flushed, pupils moderately contracted and quite insensible to light; pulse, 120; respirations, 40. Notwithstanding every means was used to arouse her, it was forty-one hours from the time the drug was taken before she was sufficiently aroused to understand and answer simple questions. When death occurs, it is from respiratory failure. It is not so depressant to the heart as chloral.

Paraldehyde Habit.—Several cases of the paraldehyde habit are on record, and the results, physical and mental, have usually been most wretched, where the habit was kept up for a long time.

Case of paraldehyde habit in which the woman had taken 1-ounce doses nightly for months, and, instead of suffering ill effects, had grown fat. Frederick Peterson (*Med. Rec.*, Dec. 10, '92).

Report of a case in which patient was accustomed to take 16 ounces of paraldehyde weekly. Patient became rapidly emaciated, suffered great cardiac and general muscular weakness, and subsequently had delusions of persecution with mental failure. Complete recovery followed restraint and appropriate treatment after three months. F. A. Elkins (*Quar. Jour. of Inebriety*, Oct., '94).

Symptoms resembling those of chronic alcoholism generally follow the long-continued use of the drug in large doses. Krafft-Ebing has observed epileptoid convulsions in these cases.

Case of paraldehyde delirium tremens in a man, 41 years of age, who was taking 2 ounces of this drug each day. He could stand with difficulty, and, although his intelligence was not impaired, his speech was labored, and words were delivered in syllables in order to improve this deficiency. His nutrition was enfeebled, skin pale, and brow covered with perspiration. The eyeballs were deeply sunken, without disturbance of motion, and his look was fixed. Pupils were in middilatation, but reacted well to light. There were no painful points on head or spine. There was marked tremor of hands and tongue, and the latter was coated. Spinal innervation was unchanged. The lungs showed marked emphysema; apex-beat was absent; heart-sounds muffled; pulmonic second sound accentuated; pulse slightly irregular, ninety to the minute, and moderately full. Abdomen was retracted. Urine was very acid, contained a large quantity of urates, of specific gravity of 1030, but free from albumin and sugar. Patient was sleepless, became delirious, had ideas of persecution and hallucinations, but improved under sodium bromide and trional, and finally was discharged after sixteen days of observation. G. Reinhold (*Ther. Monats.*, H. 6, S. 300, '97).

Treatment of Poisoning by Paraldehyde.—The treatment of poisoning by paraldehyde is directed against the paralysis of the respiratory centre. Respiratory stimulants, atropine, coffee, and the battery are indicated.

Therapeutics. — Paraldehyde is used chiefly as an hypnotic and nervous sedative. On account of its depressant effect upon the respiratory centres, W. H. Flint (*Ther. Gaz.*, Jan. 15, '90) claims that it is contra-indicated in cases of cyanosis with depression of the respiratory centres, as in the advanced stages of emphysema and cardiac dilatation; he believes it to be likewise contra-indicated in most cases of insomnia attended with much physical or mental depression. Bright's disease does not appear to prohibit the use of paraldehyde.

In the sleeplessness of chronic alcoholism, alcoholic mania, delirium tremens, and "chronic disturbers," B. D. Evans, of Morristown, N. J., finds paraldehyde the best hypnotic. In many of the forms of insanity he has found it to act well, but occasional failure follows. He has not found the drug to disturb the appetite or depress the heart's action ("*Ephemeris of Mat. Med.*," Jan., '96).

A. B. Cook has found paraldehyde serviceable in asthma, puerperal convulsions, and cough. In spasmodic asthma W. Mackie relieved the spasm by $\frac{1}{2}$ -drachm doses every half-hour for one to three doses. Humphrey has found the drug an excellent remedy in Cheyne-Stokes respiration associated with broncho-pneumonia. With the combined use of caffeine (4 to 8 grains daily) and paraldehyde (30 to 45 drops at night) Cevello found, in cases of œdema, ascites, and pleuritic effusion, that the amount of urine was increased.

Attention called to antispasmodic action of paraldehyde in asthma. Personally used with good effect in about thirty cases of asthma, including ordinary spasmodic asthma, asthma with epilepsy, with heart disease, or with renal disease, and with chronic bronchitis, and in two cases of asthma with pneumonia. In majority of cases relief was rapid and complete, and in re-

mainder distress was lessened. Dose employed was from 45 to 60 minims, and one dose was usually sufficient; a few patients needed a further dose of from 30 to 45 minims an hour or so later. The drug scents the breath strongly for about twenty-four hours. Addition of a few drops of alcohol renders paraldehyde perfectly miscible with water; any flavoring tincture can be used for this purpose. F. P. Hearder (*Brit. Med. Jour.*, Mar. 21, '96).

In asthma paraldehyde has given most satisfactory results. It is absolutely safe, not only relieving the spasm, but inducing tranquil, refreshing sleep without any objectionable after-effects. As it gives rise to no drug habit, however much its use may be prolonged, it is far more desirable and safe than either morphine or chloral.

A drachm should be used as a dose, and, as the system does not acquire tolerance for the drug, the same quantity will answer as well after months of use as at the beginning. Good way of administering paraldehyde is in expressed oil of almond. Equal parts of the oil and the paraldehyde flavored with essence of cinnamon make a palatable dose. It can likewise be given in water, milk, beer, or wine, by using $1\frac{1}{2}$ ounces or more of these vehicles for each dose of the paraldehyde. A. Macgregor (*N. Y. Lancet*, p. 127, '99).

Paraldehyde is especially indicated in the insomnia of alcoholics, in delirium tremens, morphinomania, and as an antidote for strychnine, etc. The dose varies from 1 to 2 or 3 grammes (15 to 30 or 45 grains). It is contra-indicated in those who are taking iodides. It causes a breath like that of a drunken man, which may, however, be counteracted by giving vanilla at the same time. Roques (*Jour. des Prat.*, Aug. 17, 1901).

Paraldehyde may give rise to indigestion and diarrhœa, but is seldom followed by headache or depression. Obstinate ulcers of the nose and cutaneous eruptions have occasionally followed the continued use of this drug.

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PARASITES, DISEASES DUE TO.**Intestinal Parasites.**

Parasites which infest the human intestinal tract may be divided into (1) nematodes, or round-worms; (2) trematodes, or sucking-worms; and (3) cestodes, or tape-worms.

Nematodes (Round-worms). — All round-worms occurring as parasites in man belong to the order of *Nematodes*. They have long, slender bodies of simple outline, without segments or appendages. The males are usually smaller than the females. Some nematodes as found in the human intestines are quite harmless, but others are more dangerous; a few pass into more sensitive tissues and organs, producing disturbance or even dangerous injuries.

Ascaris lumbricoides, the common round-worm, is in color a yellowish or reddish brown, cylindrical in shape, and tapering at the ends, somewhat similar in appearance and shape to the earth-worm. The female is from 20 to 40 centimetres in length; the male is smaller and provided on its posterior extremity with the bend like a hook, carrying two projections or processes. The female produces an enormous number of eggs, which, when fully developed, possess a double shell, around which is an albuminous envelope. These are found almost anywhere in the intestinal canal, but chiefly in the smaller intestine, and are very resistant to external influences. These ova mature and develop into the round-worm in the intestine, requiring no intermediate host. They attain sexual maturity in from ten to twelve weeks after the eggs have been swallowed, at which time the length of the female is 20 to 30 centimetres and that of the male 13 to 15 centimetres.

Symptoms. — The presence of the round-worm only rarely produces any

symptoms in its host; even then they are often most obscure. In children, however, it sometimes causes a variety of forms of intestinal irritation, which tends to precipitate nervous disturbances. Peiper and others suggest that these nervous symptoms are caused by an irritating toxin, derived from the round-worms. Chauffard, Marie, and Tauchon describe a condition called typholumbricosis as due to this substance. This is a complex of fever, foul breath, and intermittent diarrhoea, which continues for a month or more (Osler), and sometimes is accompanied by prolonged coma (Voucka), or follicular enteritis (Concetti). These parasites, as shown by Thermais, often act as the basis of neurasthenic, hysteriform, epileptiform, and choreiform disorders, and occurring usually in subjects offering no neuropathic antecedents. There can be no doubt of the importance of an examination of the fæces, for ova, in all obscure cases presenting reflex neuroses.

The round-worm occasionally finds its way into normal or abnormal openings in the surface of the intestinal canal, and thus produces mechanical disturbances. They are sometimes found in the fæces, and are occasionally ejected from the mouth while vomiting. They have also been known to obstruct the common gall-duct, enter the larynx, and in other ways cause more or less grave disturbances.

Possibility of mistaking certain cases of ascaris for more serious disorders emphasized. A child may be seized suddenly with convulsions which soon are followed by coma, and a provisional diagnosis of meningitis may be made until the cause is discovered in the stools and rapid recovery takes place after santonin and calomel. The number of worms found does not seem to govern the severity of the symptoms, since in quite severe cases only a few were present. An excessive secretion of

saliva seems to be a valuable symptom from a diagnostic point. J. P. Naab (Münchener med. Wochen, May 13, 1902).

Treatment.—For the removal of the lumbricoid worms nothing has been found to equal santonin, which, if judiciously used, is almost always satisfactory. It must be borne in mind that very considerable ill effects have followed the excessive or prolonged use of this drug, not only xanthopsia, but hebetude or torpor, and in some instances death. Coppola calls attention to the fact that as a result of the catarrhal condition produced by the parasites a large amount of lactic acid is sometimes found in the intestines which favors the solution of santonin and its consequent absorption. He, therefore, prefers the use of santoninoxim, in double or triple doses, as equally active, but less absorbable and non-toxic. Santoninoxim is a crystallizable body obtained by Cannizaro after subjecting santonin in an alkaline solution to the action of hydroxylamin. The dose of santonin should not be above $\frac{1}{8}$ to $\frac{1}{2}$ grain if frequently repeated, or 1 to $1\frac{1}{2}$ grains a day in children from one to six years (Demmi). A good rule is to give to a child of from two to four years from $\frac{1}{4}$ to $\frac{1}{2}$ grain of santonin along with the same amount of calomel, and after a very light supper composed of $\frac{1}{2}$ glass of milk, each night, for three successive nights. Naphthalin is recommended by Engel: from $\frac{1}{3}$ grain to $1\frac{1}{2}$ grains, four times a day, for three days.

Oxyuris vermicularis, the **seat-worm**, or **thread-worm**, also called the awl-tail, or maggot, is a small round-worm which in man sometimes infects the large intestine and the lower part of the small intestine. The length of the female is 10 millimetres and pointed at the caudal end like an awl; the male is 4 milli-

metres in length with a blunt posterior extremity provided with a spiculum. The eggs are brought forth by the female in enormous numbers, and are only developed in the intestinal tract of man or beast. These eggs are very vigorous and offer marked resistance to external agencies.

The most common symptoms of the thread-worm are itching of the anus; this is worse at night, and is accompanied by disturbed sleep and extreme irritability. The irritation resulting from the presence of the parasite may also be the cause of masturbation in both sexes.

Treatment.—In the treatment of thread-worms (*Oxyuris vermicularis*) very little has been offered in recent literature that bears the stamp of novelty. The most important agent is the mechanical and chemical cleansing of the lower bowel and the use of such drugs by the mouth as are known to either paralyze or destroy them. The indications are summed up by Sansom: first, to expel the intruders and all their ova by the use of simple aperients, kept up for several weeks, along with enteroclysis of pure water, which causes the parasites to swell up and burst; second, to prevent the entrance of ova into the digestive tract by the use only of food and drink which have been thoroughly cooked. Preventive measures, among infected children, are of great importance (Nicholson), such as keeping the nails short and clean, dipping them frequently into quassia, and enforcing isolation until a cure is effected. For the intestinal irrigation plain water suffices, if used repeatedly and for a long-enough period, which is daily for a week or two or twice a week for five or six weeks. The infusion of quassia enjoys an especial reputation in this connection, and is the remedy which we have usually used, from

three to five irrigations, on consecutive days, usually sufficing; in obstinate cases, where the infection reaches very high up, more may be required.

Solutions of Castile soap are recommended by Monti, continued for from one to three weeks. A. Gremand regards sulphur-water as the most satisfactory, *per clyisma* as well as *per os*. W. N. King recommends a saturated aqueous solution of socotrine aloes, 1 ounce of which is injected into the bowel at bed-time and retained, and this should be repeated for several consecutive nights; it is then discontinued, and, upon a return of the parasite, is again used. Engel recommends a bichloride solution 1 to 2000, but this agent should be most cautiously used.

For internal administration the first item to be considered is diet. The addition of garlic to the food enjoys a very ancient reputation.

Of drugs, the most important are those which act as laxatives, aromatics, and intestinal antiseptics. Sidney Martin recommends a mixture of rhubarb, carbonate of magnesia, and ginger in small doses.

For the relief of the anal pruritus mercurial ointment is useful; it serves the double purpose of soothing the parts and preventing the escape of the worms from the bowel.

It must be borne in mind that frequently the removal of these apparently trifling parasites is attended with the greatest difficulty, especially where there is considerable catarrhal inflammation of the colon. It is most essential in applying the irrigations that they be given thoroughly and in such a way, in obstinate cases, that they reach, if possible, the cæcum. The injection should be given through a long catheter or rectal tube, which must be cautiously inserted well up beyond the sigmoid flexure, the

child lying on its left side, for five minutes, then on its right side for five minutes,—preferably a much greater period.

Trichocephalus dispar, or whip-worm, is an entirely harmless, but quite common, intestinal parasite frequently found in the cæcum.

The size of male and female are similar: from 4 to 5 centimetres in length. The forepart of the body is narrow and the afterpart much thicker, giving it the appearance of a whip. The sexual organs are in the thicker portion, and in the posterior end a spiculum. The eggs are elongated and oval in shape, and 50 millimetres long; they possess a thick, brown shell, at each pole of which is a clear globular mass. They develop slowly and first in water and damp earth, and are very resistant to cold and dryness. The *Trichocephalus* occurs also in the domestic animals.

It rarely, if ever, produces any symptoms, even when occurring in enormous numbers.

Anchylostoma duodenale (*Dochmius duodenalis*, or *Strongylus duodenalis*) is a small worm which inhabits the upper part of the lesser intestine. It is very commonly found among the inhabitants of the tropics, especially in Egypt, and occasionally in other localities.

The female has a cylindroid body of from 5 to 18 millimetres long; the male is from 6 to 10 millimetres. The cephalic end is curved toward the dorsal surface. It is provided with a mouth, very near its extremity, pointing to the ventral side and armed with four incurving teeth on the ventral border and two on the dorsal border, all arranged perpendicularly. This acts as a sucking or biting apparatus by which the parasite fixes itself firmly on the intestinal surface, from whence it draws out blood for its nourishment. The spots over which the worm has at-

tached itself may be recognized post-mortem as areas of ecchymosis, in the centre of which is seen a white spot showing a central perforation. Occasionally the deeper parts of the mucous coat are penetrated.

The eggs are oval in shape from 44 to 67 millimetres long, and from 23 to 40 millimetres broad. They are similar in appearance to, but smaller than, the eggs of *Ascaris lumbricoides*. The first stages of their cleavage take place in the human intestine, and if these are voided so that other human beings may receive them (which is chiefly through the drinking of muddy water, where they develop still further), they develop into complete sexual maturity in their final host.

Symptoms.—Anæmia is the most important symptom of anchylostomiasis, which is also known under the names “Egyptian chlorosis,” “miner’s cachexia,” “mountain or tunnel anæmia,” and “brick-makers’ anæmia.” When a large number of parasites are introduced into the intestine an intense acute anæmia develops, but when only a few are present the symptoms are more chronic. Besides the anæmia, there may be variable appetite, nausea, pain in the epigastrium, constipation or diarrhoea, and hypertrophy and dilatation of the heart, and, in the acute form, dyspnoea and dropsy.

Diagnosis.—The diagnosis is made by finding the eggs in the fæces. These are oval, about 0.05 millimetre long, and with a thin transparent shell. There is no operculum as in the ovum of the oxyuris.

Treatment.—In the districts in which this disease occurs all drinking-water should be thoroughly boiled and latrines should be systematically employed.

Among drugs, thymol is considered a specific, and, according to Sandwith,

should be given in doses of 30 grains in a wafer with 6 $\frac{1}{2}$ drachms of brandy at 8 A.M. and again at 10 A.M. At 12 a dose of castor-oil should follow. The day before and the day after the thymol the patient is to be kept on a diet of milk and soup. This treatment is repeated once or twice until no eggs can be found in the fæces with a microscope.

The recognized treatment is thymol administered as follows: 15 to 30 grains (1 to 2 grammes) repeated four times at intervals of one and one-half to two hours. If the bowels do not act spontaneously in twelve hours after the last dose, a purgative should be given. It is well to clear the bowels the day before with a purgative, and place the patient on liquid diet. The fact that thymol is poisonous must not be lost sight of, and the patient should be carefully watched. Since the drug is freely soluble in alcohol, ether, turpentine, chloroform, oil, glycerin, and certain alkaline solutions, these should be withheld during its administration.

Podophyllin has a specific action on the intestinal epithelium which interferes with the attachment of the parasite. The latter are then easily dislodged by the administration of the extract of male fern after the podophyllin has been given, or the podophyllin may be alone sufficient to expel them. Neumann (Deut. med. Wochen., Feb. 4, 1904).

Trichina spiralis occurs in two forms: the trichina of the intestines and the trichina of the muscles—phases of their development. Sexual maturity is reached in the intestines, where it appears as a small, white, hair-like worm, the female 3 millimetres in length, the male much smaller, readily visible to the naked eye. In shape it is long and narrow, the intestinal canal beginning with a muscular mouth acting as an intestine. The organ increases in calibre, passes down into the food-canal, and is surrounded

throughout its length by a row of large cell-bodies. The eggs develop into embryos within the uterus and are set free at birth.

The embryo, or muscle trichina, which is from 0.6 to 1 millimetre in length, lies coiled up in an ovoid capsule, which is at first translucent, but later becomes opaque and infiltrated with lime-salts.

When trichinous flesh is eaten by man or by certain animals the capsules are digested in the stomach and the trichinæ liberated. Passing into the small intestine they become sexually mature in from two to four days, when they produce innumerable embryos. These embryos leave the intestines for the muscles, the mode of transmission being, according to J. Y. Graham, through the bloodstream. About two weeks after reaching the muscle they attain the larval form. The irritation caused by their presence results in an interstitial myositis and the formation of a fibrous capsule. As a rule, the capsule is occupied by only one worm, but occasionally two or three are seen together. The trichinæ may thus live for years in the muscles. According to Osler, the dissecting-room and post-mortem statistics show that from $\frac{1}{2}$ to 2 per cent. of all bodies contain trichinæ. Of 1000 consecutive autopsies of which he has notes, trichinæ were present in 6 instances. The eating of improperly-cooked pork furnishes the greatest cause of this disease in man.

Symptoms.—If only a small number of trichinæ are swallowed, no symptoms follow; but, in case of a large dose, gastro-intestinal symptoms—consisting of loss of appetite, vomiting, pains in the abdomen, and diarrhœa—develop within a few days. When the embryos begin to invade the muscles, which occurs between the seventh and fourteenth days, there are usually chills and fever. Myositis is

present and is characterized by stiffness, tension, and pain on pressure and movement. There may be difficulty in mastication and deglutition, and an intense and distressing dyspnœa may add to the suffering. Œdema, seen early in the face, is noted in almost all the cases. Profuse sweating, miliaria, itching and tingling of the skin, acne, urticaria, furunculosis, and herpes may occur. In protracted cases, especially, anæmia and emaciation are often great. Osler has noticed a marked leucocytosis, which may reach above 30,000, and may prove of value in forming a diagnosis.

Diagnosis.—In addition to the above-mentioned symptoms, the stools may afford important information. They should be examined with a low-power lens, under which the trichinæ appear as small, silvery threads. The diagnosis, when doubtful, may be confirmed by obtaining a piece of muscle from the biceps by a small instrument called an harpoon.

Acute rheumatism sometimes resembles this disease, but the joint swelling in the one and the great increase in the eosinophiles in the other will aid in separating them. Cholera, acute polymyositis, and typhoid fever may also simulate trichiniasis, and must be carefully differentiated.

Prognosis.—The prognosis should be guarded, since it greatly depends upon the number of trichinæ swallowed. A favorable symptom is early diarrhœa.

Treatment.—As a prophylactic measure, thorough cooking should always be insisted upon when pork is utilized as an article of diet.

As soon as it has been discovered that trichinous meat has been eaten, some purgative, of which calomel followed by a saline is the most useful, should be given. Senna, aloin, rhubarb, or glycerin may be tried. For the muscular pains,

hot baths and anodyne applications sometimes afford relief, while the bromides may secure the much-needed sleep. The patient's strength is to be maintained by easily assimilable, nutritious food.

Filaria.—The *Filaria sanguinis hominis* includes a number of varieties, but the three principal ones are the *Filaria sanguinis hominis nocturna*, *Filaria sanguinis hominis diurna*, and the *Filaria perstans*.

The FILARIA NOCTURNA is the most common form, the male measuring 83 millimetres in length and the female 155 millimetres. From the lymphatics, where it matures and brings forth its young, it reaches the blood-current. Here it is found only during the night, or, as Stephen Mackenzie has noted, in the daytime when the patient is a day-sleeper.

The embryo, which is about the diameter of a red blood-corpuscle, may be present in the blood-vessels in large numbers without causing any symptoms, but the adult worms or ova are apt to block the lymph-channels, producing lymph-scrotum, elephantiasis, or hæmatochyluria.

The mosquito, by sucking the blood from a person with this disease, is probably connected with the further development of the embryos. It is most likely that some change takes place within the mosquito, which, upon dying, sets free the embryos in some stagnant water where still further development occurs; this, however, has not been proved. Man probably becomes affected through the drinking-water.

Symptoms.—In hæmatochyluria the urine passed is white, opaque, and milky, or sometimes bloody with a sediment consisting of a slightly-reddish clot. The patient may be troubled with this condition only intermittently, normal urine being passed for weeks between the at-

tacks. Fat-granules, red corpuscles, and the embryos in the urine are found microscopically. Manson attributes some at least of the cases of elephantiasis arabum to the effects of the filariæ.

In LYMPH-SCROTUM, another condition caused by this parasite, the parts are very much swelled and thickened. The lymph-vessels are so distended that they are plainly visible and exude a turbid fluid upon puncture.

Treatment.—When filariasis exists, all drinking-water should be filtered or boiled and kept away from mosquitoes. In cases of chyluria the diet should be dry and devoid of fat. Thymol and methylene-blue have both been claimed by different observers to have given good results.

Manson contends, however, that the attempt to cure filaria chyluria by the administration of a parasiticide is founded on a misconception of the true pathology of this disease and the part played by the filaria in its production. The filaria stands to chyluria very much in the same relation as rheumatic fever stands to heart disease and gonorrhœa to urethral stricture; it starts the pathological process, but its constant presence is not necessary to keep it up. To attempt, therefore, to cure chyluria by trying to kill the filaria is illogical. Once established in the human body, the filaria should be left alone,—protected, rather than persecuted. Pathology indicates that the proper treatment is in principle the same as acquired varix in any inaccessible region. This should be rest, elevation, lowering of the tension in the lymphatic vessels by the use of saline purgatives, limited and appropriate food, and abstinence from fluids as much as possible.

Surgical intervention is sometimes of value in removing the adult filariæ from the enlarged lymph-glands.

Filaria, or Dracunculus, medinensis,—or guinea-worm,—is a thin, thread-like worm from 60 to 100 centimetres in length, of which the female alone is known. The cephalic end is rounded off, while the caudal end tapers to a point. The external covering consists of a firm cuticle; the uterus filled with young occupies the chief part of the body-cavity. The embryos have no shell, but merely a thick covering, with a pointed tail. These embryos are received into the human stomach through the intermediation of small crustacea and are swallowed through drinking-water. It is frequently found among the inhabitants of Asia and Africa, developing in the skin, occasioning abscesses chiefly in the lower extremities, especially about the heel.

Treatment.—The symptoms produced by the *Dracunculus* are chiefly local and little can be expected from internal medication. Oriental practitioners, however, secure excellent results from the internal use of asafœtida for a week or more; nitrate of potash, in 2-drachm doses in buttermilk, and the use of sugar-candy exclusively is said to cause the death of the worm in one or two days (R. Atmaran).

Local measures and surgical interference are chiefly relied upon by many observers. One of the simplest is the use of cold-water affusion. J. C. H. Peacocke recommends the plan of placing the limb under an interrupted stream of water as soon as the worm has made its external opening in the skin.

The *Eustrongylus gigas* is a rare parasite found occasionally in the pelvis of the human kidney. The female reaches the length of a metre. Several species of the *Dochmius* occur also in dogs and cats and also produce anæmia. Certain varieties of *Strongylus* occur as intestinal para-

sites or in the lungs, blood-vessels, or other tissues in the domestic animals.

Anguillula stercoralis (or *Pseudorhabditis stercoralis*) is a small nematode found in Italy and Cochin China. In Italy it sometimes co-exists with the *Anchylostomum*, but produces little harm except an occasional diarrhœa. The parasite penetrates the crypts of Lieberkühn, where it deposits its eggs and young, causing disturbances of the epithelium. The size of the male is 0.88 millimetre; of the female, 1.2 millimetres.

Trematodes (Sucking-worms).—The trematodes when fully developed are found, with but few exceptions, in vertebrate animals. The first host is usually a mollusk.

The **DISTOMA HEPATICUM**, or LIVER-LEECH, is a leaf-shaped sucking-worm, 28 millimetres in length and 12 millimetres in width. The eggs are ovoid in shape, 0.13 millimetre in length, and 0.08 millimetre in width, from which an embryo develops in water and attaches itself to a host of the mollusk family. Leuckart says the young of the liver-leech are protected by the limnæa in marshes in the form of radiæ or germ-sacks, in which appear later on germ-granules. From these are developed cercariæ, resembling tadpoles. When these are taken into the digestive tract of ruminant animals, or, as rarely happens, into man, they enter the bile-ducts and sometimes the intestine or inferior vena cava. When these parasites are present in animals,—which sometimes occurs and in great numbers,—the bile-ducts are obstructed, ulcerative strictures or dilatation is produced, bile-concretions are formed, and inflammatory changes are established in adjacent structures or changes produced in the parenchyma or glandular tissues. The endemic fluke disease occurring in Japan is characterized by hepatic enlargement,

emaciation, diarrhœa, and, frequently, ascites.

The *DISTOMA LANCEOLATUM* likewise occupies the biliary passages in sheep and cattle, where it occurs in small numbers and occasions no important changes; if in greater numbers, disturbances are produced in the structures of the liver. It is very rare in man.

The *DISTOMA HÆMATOBIUM*, or BLOOD-FLUKE, is very common among the inhabitants of Egypt, one-fourth of whom are said to suffer from its effects; it also occurs in Zanzibar, Syria, and Sicily. The male is from 12 to 14 millimetres in length; the female, 16 to 19 millimetres in length. They lie, as a rule, in close contact, the female in the *canalis gynæcophorus* of the male. The eggs are of an elongated oval, 0.12 millimetre in length, with a terminal or lateral spine.

Small crustaceans act as the intermediary host into which the ciliated embryo bores its way and becomes capsulated. Infection probably occurs through drinking water containing the larvæ. The parasites are found in the portal vein and its branches, the splenic and mesenteric veins, and in the blood-vessels of the bladder and rectum. The eggs, traversing the mucosa and submucosa, reach at times the liver, lungs, kidneys, as well as the bladder and rectum, giving rise to irritation, ulceration, concretions, and neoplasms. The first and most constant symptom is hæmaturia, which gradually leads to anæmia.

As to treatment, the extract of male fern internally is considered of value by Fouquet.

The *DISTOMA PULMONALE*, or BRONCHIAL FLUKE, is a club-shaped parasite about 8 to 10 millimetres in length. It is found in China, Japan, and Formosa, where, according to Ringer and Manson, it causes an epidemic disease. It is lo-

cated primarily in the lung, its presence resulting in cough, hæmoptysis, and the occurrence of small flukes in the expectoration.

Cestodes (Tape-worms).—Cestodes are flat worms about the size and color of a fragment of white tape, devoid of mouth or intestine. They increase by alternate generation, through the germination of a pear-shaped primary host (scolex, or head), and remain attached to it for some time as a long, band-shaped colony. The sexually-active members of this colony, or proglottides, increase in size the farther they are separated from their place of origin, by the formation of new members, but they have no other outward peculiarity.

The pear-shaped primary host (scolex, or head) has from two to four suckers, and is provided also with claw-like curved hooks. By means of these adhering organs the tape-worms fasten themselves to the intestinal wall of their immediate host, which is always one of the vertebrate animals. The scoleces develop from a round embryo with four to six hooks, and are found as so-called "measles," chiefly in parenchymatous organs. Later by means of passive migration they move out of these organs into the intestine of their future host.

Tape-worms which occur as parasites in man belong to different families known as (1) the *tænia* and (2) the *bothriocephali*.

TÆNIA SOLIUM.—When fully developed, this worm is from 2 to 3 metres in length. Its head is spherical, the size of a pin-head, and has permanent sucking-cups. The crown of the head is often pigmented, and has about twenty-six coarse hooks, with short rootlets. Next comes a filiform neck about an inch long. A division into segments commences at a certain distance from the head. The first

segments are short, but their length increases from before backward. They are first square, then longer than they are wide.

The mature segments begin about 130 centimetres behind the head. The sexual organs are fully developed in the earlier segments. The mature segments when stretched are from 9 to 11 millimetres long, and from 6 to 7 millimetres wide, with rounded corners.

The parenchyma of the body of both mature and immature tape-worm segments is divided into two chief layers, viz.: 1. Central, or middle, layer. 2. Peripheral, or cortical, layer.

The middle layer includes the sexual organs, also an excretory apparatus that traverses the whole tape-worm from the head to the last segment in the form of two canals. The canals are connected at the posterior end of each segment and send subdividing branches to the parenchyma.

The sexual apparatus consists of male and female sexual organs lying close together. The germ-preparing organs consist of a double ovary and a single albuminous gland. When the eggs enter the uterus from the globular body in which the first stage of development occurs, the lateral branches sprout forth and become filled with eggs. The eggs in the ovary are pale-yellow, globular cells. In the uterus they become yellowish balls with a thick, opaque shell. This shell frequently has a second envelope, and in it are imbedded nuclei. These thick-shelled balls are no longer eggs, but contain an embryo with six hooklets. While still in the uterus, development of the embryo takes place, and the segments are here impregnated. The further development of the embryo does not take place in the same host which shelters the tape-worm. If the embryos reach the

stomach of the pig, the egg-shell becomes dissolved, the embryos are liberated, and bore their way into the wall of the stomach or intestine. They proceed by way of the blood or active migration into different organs. Having found a lodging-place, the embryo undergoes changes and becomes in two or three months a cyst filled with serum, from whose wall there shoots forth, like a bud, toward the interior a scolex; from this a new tape-worm-head develops, and also a sac enveloping it. The cyst with tape-worm-head is called a "measle," or *Cysticercus cellulosæ*. The scoleces when fully developed possess a circle of hooks, suckers, water-vascular system, and numerous calcareous bodies in their body-parenchyma. If they enter the human stomach, the cyst dissolves, and develops, through formation of segments from their primary host, a new chain of proglottides, a new *Tænia solium*. The *Tænia solium* occupies the small intestine in man, and is acquired by eating uncooked pork.

The "measles" of this parasite occur almost solely in human beings and swine. There is generally only one parasite in the intestine, but there may be more, as many as 30 or 40 having been found in one individual. They cause irritation of the intestinal mucous membrane, colic, and reflex disturbances of the central nervous system.

In the tissues of swine the "measles" are sometimes single, often numerous, and single organs like the heart may be thickly sprinkled with them. In man the cysticerci occur in varied tissues, as the muscles, brain, eyes, skin, etc. In the brain they may appear as a collection of cysts like bunches of grapes, called *cysticercus racemosus*. The cysts are mostly sterile, although some may contain a scolex.

Their importance depends upon their location, but is generally slight, and even when in the brain does not always cause trouble.

Locally a slight inflammation is excited which causes a thickening of the connective tissue in the vicinity of the cyst. After the death of the scolex the cyst shrivels up, and within it there is a chalk-like mass. In this mass the hooks remain a long time. Infection with the "measles" follows the presence of the eggs, or proglottides, in the human stomach.

TÆNIA MEDIOCANELLATA (OR *SAGINATA*).—This worm surpasses the *Tænia solium* in length, breadth, and thickness, as well as in size of the proglottides. The head is without a circle of hooks, but has a flat crown and four large suckers, which are generally surrounded by a black fringe of pigment. The eggs are similar to those of the *Tænia solium*. The "measles" are found in the cow, chiefly in the muscles and heart, more rarely in other organs, and are smaller than in swine. The development follows a similar course to that of the *Tænia solium*. This worm is more wide-spread than the *Tænia solium*, and human beings acquire it by the consumption of raw beef.

Of 1063 cases of tape-worm collected, 402 cases occurred in males. The *Tænia saginata* is by far the most common, the *solium* being much less common, while but 3 cases of *Bothriocephalus latus* have been personally seen in the United States, 1 of *Tænia flavopunctata*, and 1 of *Tænia confusa*. C. W. Stiles (Med. Rec., Oct. 23, '97).

TÆNIA CUCUMERINA (OR *ELLIPTICA*).—This worm is from 15 to 20 centimetres long, and possesses a head and circlet of hooks. It occurs frequently in dogs and cats, but seldom in man.

Its cysticerci infect the louse and flea of the dog. More rarely the flea of human beings.

TÆNIA NANA.—A small tape-worm from 8 to 15 centimetres long. It has a head and four suckers and a circle of hooks and is found in Egypt and Italy.

BOTHRIOCEPHALUS LATUS, OR PIT-HEAD.—This is the most formidable tape-worm of man, and measures 5 to 8 metres in length. It is made up of from 3000 to 4000 short, broad segments. These are broadest in the middle region, and grow narrower toward the end. The length of the largest segment is 3 to 5 millimetres; width, 10 to 12 millimetres.

The head has an elongated oval or club shape. It has on each lateral border a slit-like depression, and is mounted on a filiform neck. The body is thin and flat like a ribbon, except the central parts of the segments, which project outward. At this point the uterus, in the shape of a simple canal, is found. When the eggs collect here in great numbers, the lateral coils of the uterus arrange themselves in knots, producing a rosette-like appearance. The sexual orifices lie in the median line of the ventral surface. The ovary is a double organ, which lies in the middle layer. The testicles consist of clear vesicles lying in the lateral part of the middle layer. The eggs are oval and are surrounded by a thin, brown shell.

The *Bothriocephalus latus* is found in Switzerland, northeastern Europe, Holland, and Japan. Bollinger says it is quite common in Munich. It lives in the small intestine of man. The first development of the eggs takes place in water. Months afterward an embryo develops, armed with hooklets, and covered with minute ciliæ. This develops in an intermediate host into a "measle," which, according to Braun's investigations in the Russian Baltic Sea provinces, seeks out as a mediate host the pike or tadpole, and either in the muscles or intestines of these fishes develops to a sexless tape-worm.

The "measle" of the *Bothriocephalus latus*, according to Grassi and Parona, occurs in Italy in the pike and river-perch. It is found in a Japanese fish, and in a great variety of fishes in the lake of Geneva. It is, however, most frequently found in the tadpole and perch. The "measle" may also be brought to development in the dog or cat.

The presence of the *Bothriocephalus latus* in the intestine of man may give rise to progressive anæmia, resembling pernicious anæmia. How it causes a diminution of the red blood-corpuscles and the percentage of hæmoglobin in the blood is unknown.

Symptoms.—Tape-worms are found in human beings of all ages, but they are by no means common in children. Holt's statistics are very conclusive on this point: of 10,000 cases studied, only 79 gave undoubted evidence of tape-worm. Cestodes may cause no disturbance whatever, and yet occasionally very grave phenomena, such as profound anæmia, malnutrition, and nervous symptoms. When evidences of their presence are discovered, they are liable to produce much anxiety. In nervous folks there follows frequently profound mental depression and hypochondriasis. There is some evidence to show that tæniæ produce convulsions and choreic symptoms, especially in children. The diagnosis need never be difficult, the presence in the stools of segments of the worm and ova can be demonstrated by a careful search, and are readily differentiated.

Treatment.—For the treatment of the intestinal cestodes it is necessary to prepare the patient, who should take a very light diet for two days. A large enema of cold water or a thorough saline purge should be administered in order to prepare as free a passage as possible for the worm. There are a number of remedies

advocated, of which the best is, perhaps, pelletierine, but this is not suitable for children and is also very expensive.

For children, most authorities recommend the oleoresin of male fern, four doses of 15 minims each in capsule given at intervals of an hour and followed by an active purge, such as castor-oil. It must be borne in mind that filicic acid dissolves more readily in the presence of castor-oil, and is hence absorbed in greater quantity, causing very considerable constitutional disturbance. Gross (La Méd. Mod., Mar. 20, '95) notes a case of blindness in a man, followed by optic atrophy, thus caused. Two cases, of more or less complete amaurosis, from the use of male fern, have been noted by Mazius (La Sem. Méd., July 3, '95).

For adults the dose of the ethereal extract of male fern is 2 drachms. It is customary to combine felix mas with an infusion of pomegranate-root or pumpkin-seeds. Osler recommends an infusion of pomegranate-root, $\frac{1}{2}$ ounce; pumpkin-seed, 1 ounce; powdered ergot, 1 drachm; and boiling water, 10 ounces. An emulsion of 1 drachm of the ethereal extract of male fern containing 2 minims of croton-oil is then made. After using a low diet on the previous day and an efficient laxative that night, the emulsion and infusion are mixed together and taken, fasting, the next day.

Pumpkin-seeds alone are very efficient. Three or 4 ounces should be carefully bruised and macerated for half a day and the entire amount of the infusion taken and followed in an hour by a purge. Oxide of copper, in doses of $1\frac{1}{2}$ to 3 grains three times a day, for several days, is recommended by Sasse (Med. Week blad., Aug. 14, '98), the only restriction being the avoidance of acid drinks. A purge is given at the end of a week.

Unless the head is brought away, the segments of the parasite reproduce themselves, and in three or four months show in the fæces. Where the head and neck are protected beneath the valvulæ conniventes, the remedies may not reach the parasite. Unless the worm is killed, it is probable that no degree of peristalsis can dislodge the head. This is especially true of the *Tænia solium*. A good device is to place warm water in the vessel into which the dejecta are received, as it is thus more likely to be preserved entire.

Visceral Cestodes.—The larval forms of certain of the tape-worms invade the solid organs and produce important symptoms. The two varieties which more commonly occur in man are, first, the *Cysticercus cellulosæ*, the larva of the pork tape-worm, or *Tænia solium*; and, second, the echinococcus, the larva of the *Tænia echinococcus*. The *Cysticercus tænia saginata* has been known to occur in man, but is very rare.

CYSTICERCUS CELLULOSÆ.—The ripe ova of the *Tænia solium* are occasionally received into the human stomach, either by being accidentally swallowed or forced into the organ from below. The human then becomes the intermediate host of this cestode, which is usually the *Sus domesticus*. It thence invades various tissues and organs. Pigs are sometimes found swarming with these “measles,” and in them there is rarely any constitutional disturbance except possibly at first. If in man only a few of these “measles” become established, the larvæ may die, become calcified, and produce no mischief. They are very rare in America. The symptoms produced where a considerable number occur or where the localities invaded are sensitive are sometimes very serious, and are divided by Osler into: general, cerebro-

spinal, and ocular. The *general* symptoms resemble in many instances a peripheral neuritis. When the *cerebro-spinal* tissues are involved, very pronounced symptoms may result, according as the centres are invaded or the more silent regions are occupied. The *ocular* symptoms can be more or less readily elucidated by a direct examination of the eye.

Echinococcic Disease.—This disorder, both general and local in its manifestations, arises from the invasion by the larval forms of the *Tænia echinococcus* of the liver, intestinal canal, lungs and pleuræ, kidneys, bladder, genitalia, brain, spinal cord, bones, heart, and blood-vessels, and occasionally other organs.

In America this disease is extremely uncommon and even then occurs only in foreigners with rarest exceptions. It prevails in countries where man lives in intimate association with dogs, as in Australia, Iceland, and some parts of Europe.

The *Tænia echinococcus* lives in the intestinal canal of the dog. It is 4 millimetres long, and has only four segments, of which the posterior one surpasses in length all the others put together. The hooklets are 30 or 40 in number and have coarse root-processes. Only the cyst-worm is found in man.

The development of the embryo takes place in the stomach or intestine, where the shell of the ovum is digested away; it then burrows through the intestinal wall, arriving at the peritoneal cavity or the muscle; or, falling into the portal circulation, it may be carried to the liver, which, in at least one-half of the cases, is its destination. Again, it may enter the systemic vessels and be carried to various organs and regions of the body. Upon reaching its destination the six hooklets with which it is originally

equipped disappear, and a cyst is formed, presenting two layers: a capsule and an endocyst. These embryonal cysts grow and bud, develop from the parenchymatous layer, and themselves become cysts similar to the first one. Thus, the parent-cyst as it grows may contain a dozen or more daughter-cysts, inside which last again a similar process occurs, and a series of third or granddaughter-cysts in time develop. From the lining membrane brood-capsules arise by budding; these mature into scoleces, which are found to be heads of the *Tænia echinococcus*, presenting four sucking-disks and a circle of hooklets. Should a scolex reach the intestines of a dog, it may develop into a similar tape-worm.

An interesting and important difference between the natural history of the *Tænia solium* and the *Tænia echinococcus* is that the ovum of the former develops into a single larva, whereas that of the latter forms a cyst which amplifies itself enormously and from the lining membrane of which millions of larval echinococci are in turn produced.

In man, as a rule, the growth of the echinococcus is, as described, endogenous, the secondary and tertiary cysts being contained within the primary; in animals, however, the development may be exogenous. The primary cyst penetrates between the layers and matures externally. A third form is the multilocular echinococcus, occurring in the liver only where the primary cyst-bud develops and is cut off entirely, becoming capsulated. These joining together produce a dense mass composed of connective tissue inclosing spaces in which are found remains of the echinococcic cyst oftentimes sterile: *i.e.*, without heads or larvæ. It resembles cancer, and the symptoms are those of tumor. The echinococcus lives a varying time, often-

times many years. The usual change is death and inspissation of the contents and the transformation into a mass of partially-calcified granular material. They may, however, rupture into a serous sac or external perforation, whereupon the cyst is discharged into a bronchus or the urinary passages or the bile-ducts or blood-vessels. From these effects death may follow very suddenly or recovery may ensue. Suppuration may become established, and large abscesses are sometimes formed, which contain hydatid membranes.

Symptoms.—About 50 per cent. of hydatid cysts are found in the liver. When these are of considerable size, the tumor or tumors are detectable by palpation and otherwise, the size of the organ being sometimes markedly increased. When these are small, they may not be distinguished or give rise to any disturbances. When they occur in the epigastric region on the anterior surface of the organ, they can be distinctly appreciated by touch, a feeling of density and occasionally a fluctuation being sometimes elicited. Occasionally they are found near the left suspensory ligament, disturbing the position of the heart upward, and an area of percussion-dullness can be demonstrated in the lower sternal and the left hypochondriac regions. If the tumor occur in the posterior surface of the right lobe, the liver is enlarged upward, encroaching upon the pleura, and the area of dullness in the axillary line is higher. A percussion-fremitus can be detected if the cyst lies very subcutaneously. This consists of a tremulous or vibratory movement conveyed to the fingers of the left hand while percussing at the same time with the right.

Subjective symptoms of pressure or dragging and occasionally pain are experienced in the region of the liver; lit-

tle more disturbance is caused than this. Where suppuration occurs, there are the usual symptoms of pyæmia, along with jaundice and rapid emaciation. Perforation may take place externally or into the stomach, colon, pleura, or the bronchi; where this is into the pericardium or inferior vena cava, it is, of course, fatal. To differentiate between hydatid cysts and other tumor-masses it is best to make an exploratory puncture. In some instances hooklets may be found in the fluid, which, as a rule, is clear, of a neutral reaction, and varies from 1005 to 1009 in specific gravity.

The presence of a marked enlargement in the left lobe of the liver, irregular in shape and painless, or in the epigastric region, a smooth fluctuating mass, giving the sensation of an elastic growth, suggests hydatid disease; this is especially the case if, besides, there is hydatid tremor. A syphilitic tumor of the liver is firm and rarely fluctuates. Between hydatid disease and cancer of the liver it is difficult to distinguish except through the clinical history. Hydronephrosis may readily be mistaken for hydatid disease, and can only be distinguished by exploratory puncture. The lung is affected in about one-fifth of the cases, the symptoms being those of pneumonic compression along with displacement of the heart. The pleura is sometimes primarily affected, the signs being those of an ordinary effusion; but the line of dullness is generally quite irregular and there is rarely set up an acute pleurisy. Echinococci of the lung may, when small, cause very little disturbance, but when large the symptoms of compression obtrude themselves; inflammatory changes may be set up, resulting in hæmorrhage. But this is rare.

Treatment. — Medicines administered internally can have little or no effect

upon the course of the disorder. When the cyst is large or annoying it must be treated surgically. Aspiration of the contents is harmless, and should be attempted before more radical measures. Recovery, in most instances, follows incision and evacuation of the cysts. Abscess of the liver caused by the echinococcus is obviously a serious disorder. In a large number of cases which come to autopsy the cyst is found to be harmless and the parasite dead.

The kidney is sometimes infested by the echinococci, and symptoms are set up resembling an hydronephrosis. The nervous system is occasionally affected, especially the brain—most frequently the cerebrum. The symptoms are vague, being those of tumor.

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PAROTID GLAND. See PAROTITIS and SALIVARY GLANDS.

PAROTITIS. — Inflammation of the parotid gland. From Gr., *παρωτίς* (*παρά*, vesicle; *οὖς*, the ear), the parotid gland; and *τις*, inflammation.

Definition.—Parotitis is usually an infectious disease (*infectious* parotitis), but it may result from injury (*traumatic* parotitis) or from the extension of inflammatory or malignant processes in adjacent tissues (*irritative* parotitis).

TRAUMATIC PAROTITIS. — Inflammation of the parotid gland may certainly result from injuries of sufficient severity to cause an effusion of blood into the gland or the tissues surrounding it. It may also result from burns or the application of caustics. While micro-organisms may take part in the process, the condition is quite different from infectious or septic parotitis. Unless infected with septic germs, suppuration is not common.

INFECTIOUS PAROTITIS. — Two forms of parotitis occur as the direct result of germ invasion: 1. Mumps; epidemic parotitis. 2. Metastatic, symptomatic, suppurative, or septic parotitis.

Infectious Parotitis, or Mumps.

Mumps is an acute, infectious, contagious inflammation of one or both parotid glands or other salivary glands, usually occurring epidemically. Although inflammation of the parotid glands may be caused by various germs, the disease commonly known as mumps gives every indication of being a specific disease. A period of incubation, the method of invasion, and the definite course pursued mark the disease as a specific fever. No septic germ, however, has as yet been isolated.

Incubation. — The period of incubation is exceedingly variable. That most commonly observed probably lies between 16 and 20 days. It has been given by different authorities as follows: Flint, 10 to 18 days; Holt, 17 to 20 days; Ashby and Wright, 14 to 21 days; Smith, 19 to 21 days; Jacobi, 2 to 3 weeks; Dukes, 16 to 20 days; Dauchez, 15 days; Roth, 18 days; Henoch, 14 days.

Symptoms. — Premonitory symptoms are usually slight or entirely wanting. In rare cases malaise and headache precede the actual onset for a week. There is frequently a period of invasion lasting from twelve to twenty-four hours, marked by feverishness, headache, muscular pains, anorexia, and perhaps vomiting. In very many cases the local symptoms are the first to appear. Pain is usually the first of these. It is stitch-like in character and is located in the parotid gland, but radiates into the ear. It is increased by pressure and by all movements of the jaw. It increases in severity and in many cases becomes very intense. In other cases spontaneous pain

is not felt, it being developed only upon pressure or movements of the jaw. Rilliet describes three painful points: one at the level of the temporo-maxillary articulation; one below the mastoid apophysis; the third over the submaxillary gland. Swelling soon ensues, and first appears in the depression between the mastoid process and the ramus of the jaw, forcing the lobe of the ear outward. At first the parotid gland alone is involved and the swelling assumes the characteristic triangular shape, the upper angle being just in front of the ear. As the surrounding tissues become involved, the triangular shape is lost. The cheeks, side of the neck, and regions behind the ear become swelled, the swelling in some instances extending almost to the shoulder. The tumefaction in front of the ear, however, remains as one of the distinctive marks of parotitis. The swelled area is often reddened, but more commonly the skin is normal in color and appearance. Over the gland the swelling is elastic to the touch, but the surrounding tissues are usually œdematous and have a doughy feeling and may even pit on pressure.

The pharynx and tonsils are frequently involved by the œdema, causing much discomfort. When the disease is unilateral, the head is inclined toward the affected side. When both sides are involved, the head is held rigidly upright, as every movement causes pain. The appearance is characteristic and striking, and in extreme cases the patient becomes almost unrecognizable.

Both sides are usually affected before the attack runs its course. They may be attacked simultaneously, but more frequently the inflammation occurs upon one side a day or two before it appears on the other. Of two hundred and twenty-eight cases reported by Holt, both

sides were affected in two hundred and fifteen. The interval is sometimes a week or more, but more commonly it is not more than three days. In unilateral mumps the left side is affected more frequently than the right.

The swelling commonly reaches its height on the third day, it remains stationary for two or three days, and then subsides with greater or less rapidity. The œdema of the surrounding tissues is the first to disappear. After the œdema has gone the gland is sometimes slow to gain its normal dimensions. Seven to ten days are required for the disease to run its course, but the duration of the illness depends also upon the interval between the involvement of the two sides. A patient of my own was confined to the house almost a month. The parotid on the right side was attacked a week after that on the left, and this was followed by orchitis on the eighteenth day.

The other salivary glands are not infrequently involved, and in rare cases the submaxillary glands alone are affected.

The secretion of saliva is usually diminished, but occasionally it is increased. This, together with the painful swelling of the face, œdema of the throat, and constitutional symptoms, renders the patient extremely wretched. Attempts to examine the throat are often futile, the patient being scarcely able to open the mouth. He will make no attempt at mastication and refuse food, owing to the pain during deglutition. These symptoms are especially prominent when the tonsils are involved. Even speaking is then painful. Although the swallowing of acids commonly causes severe pain, it does not always do so, and the popular belief that it is an infallible sign for mumps is erroneous.

Constitutional symptoms are usually not severe. The fever is rarely high.

The temperature ranges in ordinary cases from 100° to 102° F. It frequently does not go above 101° at any time during the attack, but in severe cases it may reach 104° or even more. Other symptoms are those common to all febrile conditions. When the swelling is extreme, pressure upon the vessels of the neck may cause headache and marked cerebral disturbance. Delirium is sometimes due to this cause. The severity of the disease varies greatly in different epidemics. In some the children are but slightly ill; in others they are quite seriously so when the disease is at its height, and are left weak and anæmic.

Epidemic of mumps in which the submaxillary glands instead of the parotids were affected. Of the 16 cases affected, 10 began by a swelling of the left submaxillary gland and 6 of the right. The swelling usually disappeared in from 10 to 15 days. Three boys complained of testicular pain. J. Hoppe (Münchener med. Woch., No. 34, '99).

Diagnosis.—The rapid onset and almost equally rapid subsidence of the glandular enlargement is a most characteristic feature of mumps. This, together with the location of the tumor and its peculiar shape and large size, distinguishes it from acute enlargement of the lymphatic nodes, as well as chronic malignant growths. The location of the tumor is usually sufficient to distinguish it from the cervical swellings of scarlet fever and diphtheria, but examination of the throat should always be made in cases in which there is the slightest doubt.

Etiology.—Although mumps is spread by contagion, susceptibility is probably less than to any of the other contagious diseases. Close contact is usually necessary. The disease is rarely carried from one person to another by a third, but that is known to have occurred. The disease

is rare under four years and very few cases in infants have ever been reported. It is rare in adult life and still more so in old age. It is most common between the ages of five and fourteen.

Case of mumps in a man 99½ years of age who, before the development of the disease, probably had come in contact at church with persons in whose family parotitis had existed. The patient died. H. J. Wolcott (Amer. Jour. Med. Sciences, Dec., '99).

The period of infection is doubtful. Contagion is possible from the first symptoms or even before the swelling of the glands has appeared. The power of infection seems to continue in some cases for several days after the first symptoms have disappeared. Isolation, to be effective, must be continued for at least a week after the swelling has entirely subsided or nearly three weeks from the first symptoms.

Epidemics of mumps occur more commonly in the fall and spring than at any other season. They vary greatly in frequency of occurrence and the extent of territory involved, occurring in some localities almost annually and in others only at intervals of many years. The infective power of the disease varies decidedly in different epidemics. Epidemics of measles and mumps are frequently associated.

Micro-organism found by von Leyden in the secretion of the parotid, obtained by catheterization of Stenon's duct, described. The organism is morphologically and culturally characteristic; it is a motile diplococcus, resembling in form, position in cells, and staining properties the gonococcus. It grows on ordinary media, also on ascitic fluid and milk, which lastly is curdled by it. Inoculation of animals, even direct injections into the parotid and the testicle, were unsuccessful. The coccus possesses a very slight virulence. Michaelis (Berliner klin. Woch., Apr. 12, '97).

Bacillus found in the blood and urine of a very severe case of parotitis occurring in an adult. It may be called the "diplobacillus parotitis." In the urine the organism is very much more numerous than in the blood. It is a small, plump rod, rather oval in shape, and about twice as long as it is broad (it is about 1 to 1.5 microns long). It stains irregularly, the ends staining very deeply, while the centre stains but faintly.

Culture-tubes containing gelatin, agar-agar, blood-serum, and Loeffler's media were inoculated, but as there were no results it would seem that this organism is not capable of artificial cultivation upon the media named. Charles F. Craig (Yale Med. Jour., Apr., '98).

Recurrence of mumps is uncommon, but is not unknown, as my own personal experience has positively demonstrated.

Pathology.—Opportunity for post-mortem study of parotitis is so rare that its pathology is not yet fully understood. So far as known, pathological changes are confined to the salivary glands. Infection probably takes place through the salivary ducts, the gland-substance being first involved. The periglandular tissue is involved secondarily. In those cases in which pathological examinations have been made the salivary ducts have been found to be occluded by swelling and inflammation of their walls. The gland itself is hyperæmic and œdematous. Suppuration is rare and probably does not occur in simple parotitis. Its occasional occurrence is probably due to pyogenic bacteria which have found admission with the specific germs.

Complications and Sequels.—Among young children complications are rare. Suppuration occurs in about 1 per cent. of the cases, according to Holt, and is usually due to some accidental infection by pyogenic germs. Deafness, due not to otitis media, but to disease of the auditory nerve, has been reported in a very

few cases. It is usually unilateral and permanent. Facial paralysis, multiple neuritis, and other nervous disorders also occur in very rare instances, and nephritis is not unknown as a sequel.

Case of paralysis of the left side following mumps. The complication lasted two years. Chavanis (*La Loire Méd.*, Nov. 15, '91).

Case in which acute inflammation of both lacrymal glands occurred in a patient suffering from epidemic parotitis. Schröder (*Zehender's Klin. Monats. f. Augenh.*, Dec., '91).

Rheumatism occurs as a complication in 2.8 per cent. of all cases, with or without endocarditis. Catrin (*Gaz. Méd. de Liège*, July 6, '93).

In the small proportion of cases that suffer from aural complications the attack usually comes on between the fourth and eighth days, and declares itself by impaired hearing, tinnitus, dizziness, nausea, and, finally, by labyrinthine deafness. The loss of hearing may be absolute. J. L. Minor (*N. Y. Med. Jour.*, Mar. 27, '97).

Two cases of suppuration of the parotid gland, with pus in the external auditory canal, a condition which must be frequently overlooked by the general practitioner and by others who have not made a special study of the subject, the pus being regarded as coming from the middle ear instead of reaching the parts, as it does do, by infiltration through the incisuræ Santorini. F. R. Packard (*Jour. Amer. Med. Assoc.*, Aug. 17, 1901).

Hemeralopia as a complication in a case reported. It lasted five days, then disappeared slowly, with the disappearance of the tumor. Nothing was found on examining the eye most carefully. The writer considers it due to the toxins of the disease. Campani (*Gazz. degli Ospedali e delle Cliniche*, Aug. 30, 1903).

A most peculiar, but characteristic, complication is orchitis. It is most common in adolescents and adults and is extremely rare in children. Among 230 cases of mumps Rilliet and Barthez saw but 10 cases of orchitis, only 1 being under twelve years. Its frequency un-

doubtedly varies in different epidemics. The disease is a true orchitis, but epididymitis in rare cases occurs either alone or complicating the orchitis. The disease is, as a rule, unilateral, and occurs usually between the eighth and sixteenth day of the mumps. A chill at the onset is not uncommon and more or less fever is an accompaniment. The acute symptoms increase somewhat slowly during a period of three to six days, when they subside and the swelling rapidly diminishes. So rapid, in fact, is the return to normal conditions that it is clear that the inflammation does not go beyond the stage of serous exudation. In bilateral orchitis one side precedes the other, as a rule, by one or two days. In many cases, as the orchitis develops the parotitis subsides, which has given rise to the theory of metastasis. In females inflammation of the breast or ovaries occurs in very rare instances. The number of well-authenticated cases of this complication, it must be said, is very small. Involvement of the thyroid gland and of the lymphatic nodes has been observed.

Series of 699 cases of mumps in which there were 211 cases of orchitis. In 163 of the cases of orchitis atrophy occurred in 103. J. Comby (*Le Prog. Méd.*, Feb. 11, '93).

Epidemic occurring at Fort Apache among the soldiers. There were 40 patients and 13 cases of orchitis, with atrophy in 3 cases. Jarvis (*N. Y. Med. Jour.*, May 27, '93).

Statistics of 626 cases of mumps in the garrison of Grenoble from 1890 to 1895. Of these, 184 cases were complicated by orchitis: 133 simple and 51 double. There were 4 cases complicated by endopericarditis, 2 by double pneumonia, 10 by multiple arthralgia, and 2 by serious encephalopathy, but there were no deaths. Trouillet (*Le Dauphiné Méd.*, June, '95).

Case in which acute pancreatitis occurred as a complication of parotitis in a boy of 10 years. Severe vomiting fol-

lowed by violent pain in the upper abdomen led to the detection of enlarged pancreas. The parotitis subsided as the pancreatic affection developed. The tumor remained unaltered after free evacuation of the bowels and persisted for some days. The case ended in recovery. H. W. Jacob (*Brit. Med. Jour.*, June 23, 1900).

Prognosis.—Mumps is rarely a serious disease. It usually runs an uneventful course, and under twelve years complications are rare. In children of the so-called scrofulous type resolution is sometimes slow and imperfect. Among 24,635 cases occurring in the army during the Civil War there were 39 deaths: a mortality so high as to lead to doubt regarding the accuracy of the statistics.

Treatment.—Cases of ordinary severity require but little medication. A mild antiseptic mouth-wash should be given with a view of preventing infection by pyogenic bacteria. The diet should be liquid and the child should be kept in bed if there is fever. Warm camphorated oil is the most soothing application that can be used locally. When there is great tension or throbbing, the ice-bag sometimes gives more relief than warm applications. In general terms, the treatment is the same as for other febrile conditions.

Buccal antiseptics diminishes the chances of testicular complications in parotitis. A 4-per-cent. solution of boric acid (very hot), thymol, or carbolic acid should be employed as a gargle, and pilocarpine subcutaneously in doses of $\frac{1}{8}$ grain once daily, to diminish the pain and lower the temperature in cases of orchitis. Martin (*Revue de Méd.*, Mar. 10, '94).

Following ointment recommended for mumps:—

R. Ichthyol,
Iodide of lead, of each, 45 grains.
Chloride of ammonium, 30 grains.
Lard, 1 ounce.

This ointment is to be applied to the swelled parts three times a day. In

some instances vaselin may be used in place of the lard, and sometimes belladonna may be added with advantage. Tranchet (*Jour. des Pract.*, May 9, '96).

Guaiacol is valuable as an antiphlogistic and antiseptic. An ointment, containing 5 per cent. of the drug, is applied once or several times a day over the whole region of the affected gland, which is then covered with a cotton dressing. Series of twelve cases, in which the swelling decreased at the second or third treatment, the pain and discomfort in chewing and swallowing likewise ameliorating. E. Grande (*Semaine Médicale*, No. 34, 1902).

Symptomatic Parotitis.

This form of parotitis is always secondary and occurs during the course of various acute and septic diseases. It is commonly unilateral and invariably terminates in suppuration. It occurs chiefly in the course of pyæmia, cholera, dysentery, the plague, and in scarlet, typhus, typhoid, and puerperal fevers.

Three cases of parotitis occurring during the course of pelvic disease. Epidemic parotitis was excluded. The first case developed during a pelvic peritonitis. The other two occurred during, or instead of, menstruation. In none did suppuration occur.

In article published by Paget, in 1887, 101 similar cases had been collected. Parotitis has been reported by Paget and others as accompanying or following pregnancy, delivery and abortion, menstruation (which it sometimes displaces), pelvic cellulitis and hæmatocele, operations on the vagina and uterus, ovariectomy and oöphorectomy, the use of the catheter and sound, blows on the testicle, operations and diseases of the bowel, gastritis and gastric ulcer, disease of the pancreas, and injuries and diseases of the abdominal wall. This varied origin excludes almost absolutely any metabolic theory, and favors a nervous one. W. S. Morrow (*Montreal Med. Jour.*, Mar., '96).

There is an intimate relation between the parotid gland and the abdominal and pelvic viscera; this close relation prob-

ably exists through the medium of the sympathetic nervous system. Suppuration and non-suppuration of the parotid gland in these cases depends entirely upon the local condition in the gland. This complication may follow any operation upon the viscera of the abdomen and pelvis, but it occurs more often after an ovariectomy. The patient's life is not jeopardized *per se* by the occurrence of this complication. The appearance of the parotid bubo usually marks the turning point of the disease. W. H. Morley (Amer. Gynæc., Dec., 1902).

Symptoms.—The onset of secondary parotitis, if it occurs during the course of the disease, is marked by increase of the fever and other constitutional symptoms. If it occurs after the subsidence of the primary disease, the complication is usually ushered in by a chill followed by fever. The location of the swelling is similar to that of mumps. Unlike the latter disease, the gland soon becomes red, hot to the touch, and throbbing. The course of the disease is very rapid, as a rule, fluctuation often being obtained on the fourth or fifth day. Occasionally the process is slow and continues for many days or even weeks. If the abscess is promptly opened, the cavity usually closes and complete recovery takes place. In pyæmia or septic conditions, with abscesses in other regions, a fatal result is very certain to follow.

Pathology.—The process is a suppurative one. The pus may discharge through the cheek or through the external auditory meatus, and more rarely into the mouth, œsophagus, or anterior mediastinum. The abscess may be confined to the parotid gland and its immediate surrounding tissues or it may be so large as to involve the muscles and other soft tissues, and even the periosteum of the bones. The middle ear is not infrequently involved, as well as the central meninges. Thrombosis of the jugular

and other veins sometimes leads to septicæmia. In rare instances the process terminates in gangrene.

In any given case of injury or disease of the abdominal or pelvic viscera, the occurrence or not of parotitis will therefore depend on the presence and the absorption in sufficient quantity of some of these various toxic agents. Suppuration is not an essential feature of the condition, but is due to the fact that the parotid gland, when inflamed by the action of these toxic agents, forms a *locus minoris resistentiæ*, and becomes secondarily infected by pyogenic organisms reaching it (*a*) by the blood-stream; (*b*) by Stenson's duct. Brennan Dyball (Annals of Surgery, Dec., 1904).

Prognosis.—The result depends largely upon the condition of the patient at the time of the onset of the parotitis. If much reduced by the primary disease, the complication often precipitates a fatal result. If it occurs during convalescence and the patient is not already reduced, a favorable result may be expected. In other words, suppurative parotitis in itself is not usually fatal. Induration and enlargement of the glands is a common result.

Treatment.—By introducing a probe into Stenson's duct at the first appearance of swelling and making pressure from the outside, a small quantity of pus may sometimes be evacuated and general suppuration prevented. If this fails, poultices should be applied to hasten suppuration. An incision should be made, with antiseptic precautions, as soon as fluctuation can be detected. The treatment throughout should be that appropriate for any acute abscess.

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PARTURITION, ABNORMAL.

The value of a careful examination, both general and local, of a pregnant woman cannot be overestimated. The

mortality-rate of parturition has been diminished during the last ten years, but it still continues high mainly because a thorough examination of the patient months before the expected event is neglected. As a result, the accoucheur is not prepared, until the labor sets in, to treat that which might have been avoided or checked by prophylactic measures. Again, a careful estimation of the size and conformation of the maternal pelvis, thus ascertaining whether or not there is a disproportion between the bony structures and foetal head, is the secret of success in a large number of cases. The recognizable causes of abnormal parturition may be *maternal* or *foetal*.

Maternal Causes of Abnormal Parturition.

These may be subdivided into general and local predisposing factors. Any constitutional vice, whether acute or chronic, predisposes to either primary or secondary uterine inertia, and thus causes dystocia. Tuberculosis, organic heart disease, malaria, acute diseases,—such as pneumonia, nephritis,—with the possibility of eclampsia, represent the *general* maternal causes most frequently encountered. The *local* maternal causes are of even greater importance, and consist of tumors, uterine or extra-uterine; pelvic deformities, including bony tumors, generally-contracted and flat rachitic pelvis, simple flat pelvis, and irregular pelvis; spasm or rigidity of cervix or abnormalities or tumors; uterine malformations, either natural or acquired; hæmatoma of the genital tract; spasm, rigidity, or abnormality of the vulva or perineum; full bladder or rectum; and placenta prævia.

TUMORS.—Fibroid of the uterus so frequently occurs as a complication of pregnancy that the condition is often considered as of no importance. So long

as the growth does not obstruct the pelvic inlet it gives rise to no trouble except possibly to predispose to hæmorrhage in the third stage of labor. Fortunately, fibroids are mostly situated at the fundus and are out of harm's way; or, being pedunculated, even though encroaching so as to materially interfere with labor by occluding or narrowing the pelvic inlet, in most cases they can be pushed up beyond the presenting part. The difficult cases are those in which large growths springing from the lower uterine wall or intraligamentous fibromata form an insurmountable barrier to delivery.

The next most frequent obstructive tumor is the ovarian cystoma. Peculiar as it may seem, small growths are more apt to cause dystocia than the greater ones. While patients with enormous cystomata rarely become pregnant, if this obtains, the cyst is usually pushed out of harm's way. The smaller varieties—dermoids, for instance—are likely to become incarcerated and so wedged in the *cul-de-sac* as to make the possibility of terminating labor by the ordinary passage practically impossible. Again, the possibility of rupture of such a tumor is not a remote probability.

In cases where a fibroid has obstructed labor and has been successfully "pushed up," if any dangerous symptoms supervene during the puerperium, cœliotomy, followed by myomectomy (or hysterectomy, if the need be), should be carried out without delay.

In a very large number of instances fibroids and pregnancy co-exist and no harm ensues, for, though the tumor occupies the pelvis in the early stages, it has become a part of the uterine tissues to such a degree that, as the enlarging organ rises out of the pelvis, it carries the fibroids with it. In the case of an incarcerated ovarian tumor it is different, for, the more the fundus of the uterus ascends, the more the ovarian

pedicle elongates and the more perfect the incarceration becomes.

From a very broad survey of this question the following deduction has been reached: Ovarian tumors have given more trouble to pregnant and parturient women than fibroids; but fibroids have been far more lethal, as they so frequently destroy puerperal women from sepsis. J. Bland Sutton (Lancet, Feb. 16, 1901).

Carcinoma is a somewhat rare condition. Early in the course of the affection the complication is not an alarming one, since the first stage of labor is rarely influenced. It is only during the ulcerative stage that the hæmorrhages, sloughing, etc., make the complication a very trying one.

PELVIC DEFORMITIES.—Pelvic deformities are comparatively rare in this country. Relative pelvic contraction,—i.e., a pelvis of average size which is yet too small to admit of the passage of an overlarge child,—however, is common enough. In truth, there is no pelvis, except one very much contracted in one or all diameters, which cannot act naturally and without assistance as the passage-way for the fœtus. A pelvis can only be said to be contracted when a particular head cannot adapt itself to that particular pelvis. This cannot be measured; it can only be estimated. A good rule in midwifery is the following: Any head, no matter how large, which can adapt or engage itself in a pelvis, no matter how small, can safely pass through the pelvis. The only exception is the funnel-shaped pelvis, which is so exceedingly rare that its occurrence need hardly be taken into consideration. A pelvis with normal or supernormal measurements can be as contracted for the passage of a large unyielding head and cause the same interference as a pelvis whose size is estimated as small or much below the normal; or, on the other hand, a very

decided degree of pelvic contraction or distortion is no barrier to the passage of a sufficiently small child at term.

In a series of 95 cases of kyphotic pelvis, 30 per cent. of which were universally contracted, three-fourths of the cases terminated by spontaneous labor, one-fourth prematurely. Klein (Archiv f. Gynäk., B. 50, H. 1, '95).

Series of 60 cases of labor in various forms of contracted pelvis in which 25 cases were delivered spontaneously. Guéniot (Bull. et Mém. de la Soc. d'Obstet. et de Gynéc., Apr. 18, '95).

Records of 6000 cases of pregnancy summarized in which contraction of the pelvis was noted in 654,—10⁹/₁₀. Comparison of the measurements of the head, weight, and length of the child with the measurements of the pelvis gave no definite results. In 87 per cent. (563 of the 654) delivery was spontaneous. In all of these cases the contraction was slight, the true conjugate being three and one-half to three and one-third inches. Austin Flint, Jr. (Med. Rec., Oct. 26, '95).

The funnel-shaped pelvis is one in which the pelvic inlet is normal, but its outlet becomes gradually narrower (simple, genuine, funnel-shaped pelvis). The diameter at the outlet alone would offer no cause of dystocia to a full-term living child with an easily molded head, but it forms an absolute cause of dystocia on account of the participation of both head and pelvis. Induction of premature labor changes the absolute impossibility of birth to a relative one, depending upon the character of the pains, the position of the fœtus, the size and molding capacity of the head, and the degree of mobility of the pelvic joints. Richter (Zentralb. f. Gynäk., Oct. 3, 1903).

The *unknown* elements in all these cases are, first, the size of the child's head and its condition, and, second, the force and vigor of the uterine action. To measure the size of the unborn foetal head even at the present day, we must rely solely upon an estimate obtained

by external means, including the adaptability of the head to its own particular passage-way. Yet the pelvimeter and pelvimetry afford a degree of information that it is not our intention to overlook. Thus, narrowing of one or more of the pelvic diameters should always make us suspicious and apprehensive as to the outcome and inspire unusual care in watching the progress of such a case. But never because of a pelvic contraction, except possibly where the history of prior difficult and dangerous labors is obtainable months before the advent of labor, should the patient be advised to elect any operation, until the size of the foetal head, as compared to the size of the maternal pelvis, is ascertainable.

[In doubtful cases, in view of the safety of anæsthesia, examination under ether should be the rule, for then the hand in the vagina may estimate the capacity of the pelvis and the adaptability of the presenting part. E. H. GRANDIN.]

The generally-contracted pelvis is the most frequent form and is more apt to give rise to difficult labor than either the simple flat or the flat rachitic pelvis, because of the narrowing in all diameters and the absence of a compensatory enlargement. Where compensatory enlargement occurs in one or another of the diameters, Nature seems to find this wider path to force the well-flexed head through, and studiously avoids the narrowest, most frequently the antero-posterior or oblique, the transverse, as a rule, being the compensatory diameter.

Clinical study of the development of Indian children and of the size of the pelvis in the mother. It was found that there existed a distinct ratio between the size of the child and the conjugate diameter. As the weight of the child increased so did the size of the conjugate diameter. The writer believes that in most cases the molding of the

head is largely due to the soft parts. When the head fits tightly in the pelvic brim it may be compressed by the pelvis during labor and subsequently expanded during its passage through the remainder of the birth canal. The writer concludes that, except in the case of small pelvises, a parallelism of the biparietal diameter of the head and the conjugate diameter of the pelvis is the result of natural growth and not of pressure. His conclusions are summed up in the statement that the child grows in utero in such a manner that its size is proportional to that of the mother's pelvis. Lane (Lancet, Sept. 26, 1903).

SPASM OR RIGIDITY OR OTHER ABNORMALITIES OF THE CERVIX.—These are potent and frequent causes of dystocia, their tendency being to very materially prolong the first stage of labor. The spasm of the cervix may be due to reflex conditions, such as malpositions of the foetus, but a most frequent cause is a general neurotic state of the patient. The pains existing are very severe and lasting, while no material progress takes place in the cervical dilatation.

The diagnosis is positive if, on examination, the edges of the os are found very rigid, but thin, having a razor-like edge, very hot, extremely painful, and tightly hugging the head.

Rigidity of the cervix is, as a rule, the result of previous cervical lacerations or of a prior existing chronic cervical endometritis, both conditions producing more or less marked cicatrizations of the cervix. In old cases the cervix is sometimes as hard as iron.

Atresia of the cervix in labor is in all cases due to inflammation of the cervix, which, in the early stages of pregnancy, leads to adhesion of the granulating surfaces of the cervical canal. When labor begins, the upper part of the cervix yields and thins out, while the lower portion remains undilated, and the os is not to be discovered by digital examina-

tion. As labor advances the cervix descends, and finally appears at the vulva or even protrudes beyond the orifice in the form of a dark-red, thick-walled, fluctuating tumor, which becomes tense with every pain. The os is concealed by the perineum, and is to be sought for on the posterior aspect of the presenting mass. It may be median or to one or the other side of the middle line. When detected, its position is indicated by a small circle of brighter hue than the rest of the surface. The treatment consists in scratching with the finger-nail and then dilating with the finger. Rupture of the membranes should in all cases be delayed as long as possible. Campbell (Brit. Med. Jour., Oct. 23, '97).

MALFORMATIONS OF THE UTERUS.—Bicornate uterus and other congenital malformations, as well as acquired states of the vagina, give, as a rule, very little trouble during labor, since the patient either aborts early or, if pregnancy advances to full term, Nature takes care of the malformations.

Occasionally a congenitally-deformed uterus ruptures at term, but this complication is rather as much an accident as though it occurred in a normal uterus.

Pathologically-deflected uteri, the result of a prior existing pelvic peritonitis, are seldom causes of dystocia at term. If the pathological condition is extreme, these patients seldom become pregnant normally, and are more likely to be the victims of an ectopic pregnancy. If the adhesions which bind the uterus in a false position are not too old, the growing uterus will stretch them sufficiently to allow that organ to assume its normal position. If not, abortion is the usual result.

[In instances of this nature, the woman being exceedingly anxious for offspring, the possibility of avoiding abortion by operative separation of the adhesions is justifiable in view of the slight risk. E. H. GRANDIN.]

TUMORS OF THE LOWER GENITAL TRACT, including hæmatoma, are rare complications, and yet when they do occur produce very alarming conditions. S. Marx has, on two occasions, been compelled to perforate in the presence of enormous vagino-vulvar hæmatomata, which absolutely prohibited any one form of delivery. The pathological entities under this heading produce more or less narrowing of either the cavity or the outlet of the pelvis.

SPASM, RIGIDITY, OR OTHER ABNORMALITY OF THE VULVA OR PERINEUM.—Predisposition to these conditions attends those that are too young, in whom the parts are undeveloped and unyielding, or, on the other hand, those in whom spastic contractions of the sphincter exist. They are also apt to occur in women who conceive late in life, whose genital tract is hard, cartilaginous, and resisting. In another class, in which previous lacerations give rise to firm cicatrices, an almost absolute barrier is offered, which can only be overcome by radical measures.

[In a case lately seen by the undersigned the head was *in situ* at the vulva for twenty-three hours before forceps delivery was undertaken. There followed the most extensive gangrene and sloughing of vulva and perineum as is possible to imagine. S. MARX.]

FULL BLADDER AND RECTUM.—This constitutes one of the most prolific causes of difficult and prolonged labors. One would suppose that a normal bladder would functionate spontaneously, but this is not the case. By disturbing the axial relation between foetus and pelvis, owing to displacement of the uterus by an overdistended viscus, grave and marked symptoms arise. These, however, can be readily arrested, as soon as the cause is discovered. With equal force can an overdistended colon and

clogged rectum produce the same disturbance.

Fœtal Causes of Abnormal Parturition.

When we consider that the fœtus causes dystocia either by being oversized or by presenting itself in a vicious position, our lines of treatment are very materially simplified. Here, again, a large unyielding head attempting to pass through what is usually considered a normal pelvis produces such disproportion between head and pelvis that the latter must be considered contracted so far as that particular head is concerned. If the head is unusually large or refuses to mold, we may be confronted with a condition which would warrant us in seriously considering a major operation in order to effect delivery. This same statement holds equally good in an unrecognized vicious position of fœtus. The fœtal causes of dystocia may be enumerated as follows: Too large a fœtus, including partus serotinus; prematurity; multiple pregnancy; monsters; hydramnios — oligohydramnios; adhesion of membrane or decidua; thick membranes; malposition; malpresentation.

ABNORMALLY LARGE OR SMALL FŒTUS.—A fœtus which is oversized has a decided influence in causing dystocia. The subject has been referred to elsewhere in this article. True partus serotinus is rare, but it undoubtedly does occasionally occur. Here the pregnancy is prolonged, the woman even carrying the fœtus as long as 11 months. This is verified by the unusual size of the child, the long hair, and the long, firm finger-nails. Too small a fœtus or one that is premature gives rise to complications, because it has a tendency to assume a vicious position.

MULTIPLE PREGNANCY.—Multiple

pregnancy, because of overdistension of the uterus or again because malpositions in this case are the rule, is a frequent source of difficult labors.

In twin labors, as the first child is born the second should be immediately extracted by the feet. In this way the mortality for mothers and children will be rendered as small as possible. Stephenson (*Scottish Med. and Surg. Jour.*, Nos. 1 and 3, '97).

MONSTERS.—Hydrocephalus, joined twins, congenital tumor, anacephalic monsters, either because of their size or their tendency to present pathologically, are nearly always the cause of difficult labors.

HYDRAMNIOS.—Hydramnios, by overdistension, acts similarly to multiple pregnancy, while the opposite condition, oligohydramnios, is nearly always associated with grave malformation of the fœtus. This, with the absence of the water-wedge to dilate the os, usually produces a very prolonged first stage.

ADHESION OF THE MEMBRANES or persistence of the decidua in the neighborhood of the internal os or very thick and resisting membranes, the result of a chronic deciduitis, is a causal factor which can produce as much trouble as an occlusion of the external os. Indeed, it often simulates the latter condition. Unless recognized and measures be taken to overcome the occlusion, it is not impossible for a uterine rupture to occur.

MALPOSITION AND MALPRESENTATION.—Under this subdivision we have the most prolific causes of dystocia. The great danger lies solely in the fact that when a malposition more than a malpresentation occurs it is seldom recognized. We refer especially to occipito-posterior positions, than which no more troublesome complication arises. We emphasize the fact that a malposition of a normal presentation is possible. Similar

malpositions would include chin-posterior cases and brow cases. The fault in the non-recognition of these cases always rests with the physician. Most examinations are perfunctory; the attendant rests satisfied so long as he feels the round bony head, whether engaged or non-engaged.

Characteristic of all vicious positions are early rupture of membranes, slight nagging pains, and slow or absent engagement of head. Non-engagement of the foetal head always means either a malposition or a relative or absolute pelvic contraction; in short, a pathological condition. The *accoucheur* might possibly err in failing to find a pelvic distortion or contraction; he must never fail, however, to clear up a malposition. If this is not possible by the ordinary means, he must insist upon the introduction of the whole *aseptic* hand into the uterus to clear up the condition, although this requires anæsthesia. It is evident, reasoning from practical experience, that, since contracted pelves in this country are rare, the most frequent causes of dystocia can be ascribed to malpositions and malpresentations. Early recognition and timely interference as the case demands, operating then and there only when the indications present, is here the secret of absolute success.

Out of 400 cases of occipito-posterior positions collected, spontaneous rotation forward occurred in 353.

In failure of rotation the hand was introduced to dislodge the occiput from the sacrum, and, when further rotation was required, Tarnier's forceps was found especially useful. Maternal mortality, 0.5 per cent.; of 660 contrasted cases of occipito-anterior position, 0.46 per cent. Foetal mortality in occipito-posterior position, 2 per cent.; in anterior position, 0.76 per cent. It was found necessary to apply the forceps at

the pelvic inlet in 6 per cent. more cases than in anterior positions. Bataillard (*Annales de Gynéc. et d'Obstet.*, Aug., '89).

Treatment.

Prophylactic Measures.—We must presuppose that the pregnant woman has been very carefully examined in advance from a physical stand-point and every constitutional abnormality noted, and that any disease of an organic nature discovered has been so treated as to avoid complicating factors. It is assumed that every means has been utilized to place the patient in the best possible position to help her to safely pass through the trying hours of pregnancy and labor. To fail in methodically examining the urine and to obtain a careful estimate of the excretion of urea in twenty-four hours might prove a fatal dereliction. This should be repeated every two weeks. Albumin means very little, more of a danger-signal than anything else; on the other hand, patients sometimes die of eclampsia without the faintest trace of albumin in the urine. It is the urea or its derivatives and toxins of uncertain nature that kill, not the albumin. *It is when the amount of urea diminishes that the accoucheur should look out for storm, even though no albumin be present.* Rest in bed, milk, actively stimulating all the emunctories, and, in the event of their failing, deliberate induction of labor are indicated. In women of flabby build with considerable adiposis, in whom we suspect a fatty degeneration of the uterine muscle, good results are claimed for the continuous use of small doses of strychnine throughout pregnancy or small doses of quinine for their salutary effect in stimulating the uterine muscles.

It sometimes happens that a woman will go from one pregnancy to another, always losing the child either artificially

by instrumentation or from the results of a prolonged labor, in whom, while the pelvis is normal, the children are all very large. This constitutes a pelvis which is relatively contracted. Much can be done to reduce the size of the child by appropriate treatment, either medical or dietetic.

[I think I have gotten at least questionable results by exhibiting small doses of thyroid extract from the sixth month of pregnancy. In these cases the child showed marked torpidity in its movements *in utero*, and was somewhat below the usual size and weight as compared to the children the mothers had had at previous accouchements. S. MARX.]

Much can be done by the so-called Trochowonick dietetics from the sixth month of pregnancy: forbidding sweets, pastries, fats; ordering regular exercise, and limiting the diet to meats, green vegetables, acids, and stewed non-sweetened fruits.

Under prophylaxis we must call attention to pelvimetry. We never measure a patient's pelvis for the sole purpose of fixing the time in advance for the termination of labor, unless the pelvic distortion be so extreme as to warrant immediate interference, or justifies an abdominal section at term. We always estimate the size of the pelvis as compared to the size of the head; and when the time comes when by suprapubic pressure we find the head fits snugly or fails to engage, be this at the seventh, eighth, or ninth month,—providing the patient does not insist on a Cæsarean section at term,—we proceed at once and induce labor. We never tell a patient that because of a pelvic contraction she must have labor induced at the sixth month. We perform the suprapubic manipulation once in two weeks during the last three months of pregnancy, and an attempt is made to get the head engaged into the pelvis. When

this fails, labor is induced.

Curative Treatment.—The curative treatment may be divided into: (1) medical; (2) postural; and (3) surgical, the latter affecting both mother and fœtus.

The MEDICAL TREATMENT of dystocia resolves itself into the treatment of prolonged first stage. There are a number of valuable drugs that can be earnestly recommended in the abnormal dilatation of the first stage. It is, of course, of the greatest importance to ascertain the cause, if possible, of the condition. This once removed, the labor will in all probability be rapidly terminated. Evacuation of the bladder and colon, the careful and thorough examination of the presenting part to discover, if possible, a malposition, even to the extent of introducing the full hand *in utero*, will materially assist the treatment. We have in the sedative drugs—viburnum prunifolium; opium and its derivatives, as morphine and codeine—very valuable agents in a certain class of cases.

When the pains are weak, irregular, nagging and exhausting, they assume the character of the so-called “false” pains and may last several days; while there is no appreciable effect on the cervix, the patient is gradually, but surely, being worn out. Here the administration of viburnum, 1-drachm doses every hour, or codeine is indicated. Morphine is objectionable since the after-feeling and its inhibitory action on all the emunctories are very disagreeable features. More valuable than any other drug is chloral in 10-grain doses, administered hourly till the patient experiences relief.

In quinine we have a most wonderful agent in connection with the parturient uterus. Indications for its use are very pronounced in cases in which the pains are regular, though weak. Such pains

have no influence on the progress of labors. They simply represent weak physiological uterine contractions. They can be wonderfully stimulated by quinine in full doses, 20 grains by the mouth or 40 grains per rectum. Quinine does not act like ergot, which ought never to be used before or during parturition. Ergot causes permanent spastic uterine action, no alternate contraction and relaxation, while quinine influences the uterine pains by intensifying them and causing regular firm contractions and complete relaxations. Of course, its administration is limited to the first stage of labor, dystocia in the second stage being always amenable to manual or instrumental interference. Strychnine acts similarly to quinine, but is not nearly as efficacious.

A third set of drugs which can be called sedative and antispasmodic are gelsemium in the form of the tincture, chloral, chloroform, and ether, and, locally, hot water. In cases of labor, occurring especially in young neurotic, weakly women, the following classical picture is often presented: The pains are hard and trying from the beginning; while regular enough, they partake more of the character of a local spasm. The woman cannot control herself and throws herself about restlessly. She calls for assistance and is soon exhausted. Locally there is revealed an os admitting one or two fingers, even after many hours of suffering. The head is closely pressed against the lower zone. The rim of the os is hot, painful, and tender and its edges feel extremely tense and sharp. Such a finding warrants the administration of one or other of the above drugs. Chloral in 15-grain doses every fifteen minutes, four times, or the administration of chloroform from drop doses during a pain to anæsthesia of the

obstetrical degree, with or without continuous local irrigation of sterile and very hot water, work wonderfully. They cause the spasm to disappear, the os to rapidly dilate, and place the patient in a condition in which at least the pain is bearable. Ether is not of as great value as chloroform, since experience has shown that it does not relax spasm as readily as the latter. Adjuvant measures to be thought of are mustard paste to the small of the back and firm pressure against this part by hand or pillow.

Chloral hydrate is very valuable in labor where the progress is slow on account of rigidity of the os. No other remedy in the pharmacopœia equals it. It relieves the pains and restlessness, helps to dilate the cervix, and makes the progress of labor more rapid. The writer generally gives it in 10-grain doses every hour for two, three, or four hours. He reports a number of cases to illustrate the value of the drug in this condition. H. R. Garland (Mass. Med. Jour., Oct., 1903).

THE POSTURAL TREATMENT has been little recognized, and consequently few obstetricians use it in their methods of treatment. In practice the various positions offer most valuable assistance. They are divided into (1) the right and left lateral position, (2) the knee-chest, (3) exaggerated lithotomy, (4) the Walcher, and (5) the Trendelenburg.

The *lateral postures*, right and left, are of signal service in posterior position of the anatomical head, or in anterior positions in which by turning the patient on the side the pains are intensified. Their rationale is not clear, but the supposition is that they overcome the extreme uterine obliquity present in these cases, causing the foetal spine to be straightened and consequently to become more rigid. This makes it possible to carry the force of the contraction directly along practically a straight

line, in this way influencing and increasing flexion or extension of the head, according to whether the vertex or face presents. In these cases the patient is turned on that side corresponding to the position of the presenting part, in R. O. P. vertex cases on the right side, or, again, L. P. face on the left side. In a majority of these malpositions speedy rotation occurs as a result of these manœuvres.

The *knee - chest position* has been recommended by many as a manipulative position for purposes of operation. It is claimed that versions can be more readily done and that a prolapsed cord will of its own weight fall back into the uterus. This we have never been able to confirm. In performing versions in this position our experience has shown that not alone the foetus, but the whole uterus, is drawn much too far away by force of its own gravity to make the operation easy or satisfactory. In prolapsus funi a deliberate version is far more preferable to measures such as this or others which at best are uncertain and not reliable.

The *exaggerated lithotomy* and the *Walcher positions* are hyperflexions of the lower trunk and legs in the first named, and exaggerated extension of the same in the last named. The lithotomy position is the usual position for delivery in this country. By assuming this decubitus, the pelvic outlet is materially enlarged in all its diameters, at the expense of the pelvic inlet. Its rationale is the reverse of the Walcher, which will be more fully explained below. Indications for this position would hold only in contractions at the outlet or for the purpose of increasing the diameters in normal cases. This would obtain in cases in which the head remains fixed for many hours at the out-

let, owing to an apparent or real minor contraction of that part, possibly as a result of a pseudomasculine type of pelvis.

In the Walcher position we have a really valuable source of assistance. By hyperextension of the trunk, the buttocks overhanging the table and the feet swinging free over the floor, the patient being held in place by roller sheets passing under the armpits, there occurs an increase in the size of the diameter of the pelvic inlet of from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch, at the expense of the pelvic outlet. This increase in the conjugata vera is primarily due to a rotation of the ilio-femoral joints. This pushes the sacrum at the sacro-iliac joint backward, because of the laxity of the posterior ligaments. The axis of the pelvic brim presents downward at an angle of about 40 degrees.

This position is indicated in minor pelvic contractions when the head fails to engage. The patient may be placed in this position and left there for some time till the head engages. In versions for minor contractions as the head passes the pelvic inlet it is of great service. But it must be remembered that the enlargement is always at the expense of the outlet, and, as the presenting part passes the obstruction, the patient must be thrown into the exaggerated lithotomy position to enlarge the pelvic outlet. The great value of the Walcher position lies in the fact that it has very materially limited the field for the operation of symphysiotomy, not to mention the positive increase in size obtained at the pelvic inlet.

Walcher's position employed at the Dresden Maternity Hospital in 21 cases. Pelvic contraction was present in each instance,—mainly, of the flat rachitic variety, the conjugate diameters varying from six and a half to nine centimetres. Excellent results followed the

employment of this position in 18 of the cases; in 10 of these, notwithstanding the increase in the diameter, a spontaneous delivery was even yet impossible. The increase varied from one-half to one and a half centimetres in nearly each case. The accuracy of this observation was verified by measuring the diameters of the foetal head, which in many instances considerably exceeded the diameters of the pelvic inlet. As is usual under these circumstances, the uterine pains were feeble and irregular, but as soon as Walcher's position was adopted they became stronger and more regular. Walcher's position is of service only if the foetal head is still free and movable above the pelvic brim, or has only entered the inlet with but a small portion of its diameter. Huppert (*Archiv f. Gynäk.*, B. 56, H. 1).

Walcher's position is indicated in:—

1. Cases of protracted labor in which the dimensions of the pelvis are normal or the antero-posterior diameter is somewhat shortened, the head being above the brim. The patient being placed in the position of extreme extension for an hour or more, the pelvic joints may become so relaxed or the antero-posterior diameter lengthened by the necessary half-inch, that the head will engage and labor be terminated normally or with forceps. The high forceps operation, version, or symphysiotomy are thus avoided.

2. Cases in which version, either cephalic or podalic, has been performed, or footling or breech cases. The flat pelvis, the generally-contracted pelvis, transverse positions, and occipito-posterior positions are in this category.

3. Cases in which some form of operative procedure has already been adopted without success. It has thus far been used after high forceps operations, version, symphysiotomy, craniotomy, and low forceps, and it will probably be shown to have a still more extensive field. A. F. Currier (*Med. Rec.*, Feb. 8, '96).

The *Trendelenburg posture* is of great value as a position for the total extirpation of the pregnant uterus or in acute collapse after labor. It has been

advocated for versions and in the treatment of prolapsed cord. An ironing-board, or a reversed chair will answer every purpose for this position, the patient being fastened by rolled sheets.

In obstetric operations a combination of Trendelenburg and Walcher positions recommended. It is suitable for high forceps, version, high manual internal rotation for occipito-posterior position, reposition of cord, etc. The combined position is effected as follows: In maternities the patient is placed on the Trendelenburg incline, and slid upward till she balances on her sacrum, the legs hanging over. In private practice a plain wooden chair with a flat back, and no rungs between the rear legs, will serve the purpose. The chair is placed on its face across the foot of the bed, the back forming the incline for the Trendelenburg position. A blanket or double sheet is laid along the chair-back and may fall over the chair-bottom. The patient, when anæsthetized, is placed on the inclined plane in such a manner that the buttocks rest on the upturned back edge of the chair-seat, and that they project a little beyond the chair-seat toward the operator, so as to give him unimpeded access to the vagina between the rear chair-legs. The patient is held in this position by means of a sheet twisted into a rope, and passing behind her neck and in front of the shoulders, while the two ends are made fast to the rear legs of the chair. Each knee is then grasped, and the legs swung outward until the thighs hang outside of the upturned chair-legs. The weight of the lower limbs causes them to drop toward the floor, with the knee lower than the hip.

The combination of the Trendelenburg with the Walcher posture levels the birth-canal, and does away with the necessity of the operator sitting on the floor or working from beneath in a most uncomfortable position. Dickinson (*Amer. Jour. of Obstet.*, Dec., '98).

Surgical Treatment.—SURGICAL MEASURES INDICATED IN MATERNAL IMPEDIMENTS TO LABOR.—As minor surgical measures to influence tardy

pains, we have but to mention, for purposes of completeness, the use of Barnes's bags and the elastic bougie. The bougie is indicated in cases in which the pains, on the one hand, are tardy and inefficient, while Barnes's bags are to be used when for some reason or other the cervix fails to dilate and there is a distinct indication for an early termination of the labor. We have in our modern manual dilatation of the os, however, a surer, safer, cleaner, and more scientific method than the two mentioned. By successive introduction of one finger after another into the lower uterine zone, we have, with few exceptions, been able to dilate the os, sufficiently, at least, for the purpose of delivering the child. This method has for the last five years been our method of election, not alone in tardy first stage, but in the induction of premature labor. The results have been almost uniformly successful, especially in cases of placenta prævia.

When the cervix is obliterated and the os will admit the dilator without difficulty, dilatation can be carried out in about twenty-five minutes, and there will be little or no laceration. In cases where the pregnancy has advanced to or near term, even although the cervix is not obliterated, dilatation may be accomplished with comparative safety to the cervix, provided care, time, and patience are expended in the operation. In cases of early pregnancy, with the cervix unobliterated, there is a decided risk of extensive lacerations, even though the greatest care is taken. J. M. M. Kerr, *British Medical Journal*, Jan. 9, 1904).

DEEP INCISIONS OF THE OS CERVICIS.

—Deep incisions into the os uteri after the disappearance of the cervix are sometimes indicated in cases demanding rapid delivery. Four incisions are made, reaching from the cervico-vaginal junction downward in such a manner as com-

pletely to dilate the os by the bloody method, as does Nature by her own unaided efforts. Since no important vessels are cut, primary suture is not necessary. The field for this operation is extremely small, and limited to those cases in which instant delivery is indicated: rapidly deepening coma from eclampsia, embolus of the lung, severe accidental hæmorrhage, impossibility to dilate by other means, a spastic or cicatricial os. The presence of the cervix is a contra-indication to its performance, since, with this, we get a persistence of the internal ring. Its effacement can be effected by dilating the cervix by the rubber bags or the finger, until the cervix has merged into the lower uterine zone.

In the Prague maternity school, in 3855 labors (1892-95), incision was practiced 24 times, namely: one incision in 1 case, two incisions in 8 cases, three in 9, and four in 6. In 11 cases the incisions were sutured after labor, 7 uniting down to the edge of the external os by first intention. Indications for incisions were: prolapse of cord, 3 cases; eclampsia, 3; dangers threatening fœtus, 17; cancer of the portio, 1. Delivery was completed by symphysiotomy and forceps in 3 cases, by the forceps alone in 14, by turning and extraction in 5, and by perforation and cranioclasty in 2. The puerperium was normal in 17 of the patients; in 3 there was a slight rise of temperature; in 2 parametritis; in 1 mastitis; and in 1 endometritis, salpingitis, peritonitis, and fatal sepsis. Barkman (*Centralb. f. Gynäk.*, No. 32, '97).

DEEP VULVO-VAGINAL INCISIONS, on one or both sides, is a means of dilating the vaginal outlet when, from immaturity on the part of the patient, spasm or old cicatrices make delivery highly dangerous to the integrity of the parts or impossible. Starting at a point superior to the posterior fourchette and making a deep cut obliquely downward and

outward from the vagina effects an incision through, not alone the sphincter ani, but also through the anterior fibres of the levator-ani muscles. This gives a diamond-shaped wound, which can be readily stitched up after the delivery. Its advantages over a simple episiotomy are evident, when we remember that such a very superficial incision has always a tendency to tear farther and so produce irregular lacerations, difficult to sew up, instead of clean, surgical incisions which come together with great nicety by suture.

FORCEPS.—This most important and useful instrument in the entire domain of obstetrical surgery is both conservative and preservative. Conservative in the sense that it saves both mother and child the results of physical injury; preservative by actually anticipating the possibility of immediate or ultimate death of the mother or her unborn child. Still, the forceps should never be used unless there are positive indications for its employment. The head must be in a normal position, or so relatively normal that operative interference will readily convert it into one. It is always better, however, to convert faulty positions by manual methods before having recourse to instrumental interference. In a face case, chin behind, for instance, manual flexion of the head should be resorted to, to convert it into an occipito-anterior, forceps delivery being then accomplished. It is only applicable when the membranes are ruptured and the os is dilatable or nearly fully dilated. The head must be engaged or at least fixed at the brim.

Series of 2926 deliveries in the Basel Hospital, between May 1, 1887, and December 31, 1893, of which number 156, or 5.33 per cent. of the total number, were delivered by the forceps, and of these 129 — 83.3 per cent. — were pri-

miparæ. Presentation in the second position was the most frequent cause for their use. Loss of blood was estimated at 19 ounces on the average. In 132 cases—84 per cent.—perineum was ruptured, and wound healed by primary union in 92 cases. Mortality from all these deliveries was 1.28 per cent., but this was not due to the application of the forceps. Infant-mortality was 12.2 per cent.,—5.7 per cent. being the result of use of forceps. Their use is recommended when pains diminish owing to prolonged labor, when the head is in a proper position, and when the second stage has lasted more than two and a half hours. Schmid (*Jour. Amer. Med. Assoc.*, Dec. 15, '94).

Results of use of forceps in 2920 labors. Birth was completed by forceps in 3.63 per cent. of cases. Majority of cases were primiparæ, between 20 and 30 years old. In 60 per cent. of cases the mother was lacerated. Maternal mortality was 4.7 per cent., while 11.32 per cent. of children perished. Of mothers, 1.8 per cent. had septic infection. Conclusion reached, from comparing the use of forceps with other methods of delivery, is that the forceps is the bloodiest method of delivery, and that its mortality-rate renders it a serious procedure for mother and child. Other means of accomplishing delivery should be exhausted before recourse is had to the forceps. Shick (*Monats. f. Geburts. u. Gynäk.*, B. 1, H. 6, '95).

Conditions and the indications held at Budapest to justify the use of the forceps are: that the os uteri must be completely dilated; membranes ruptured; the head must be presenting in a position suitable for the forceps, or at least its greatest circumference must be lower than the brim; the head must be of a suitable size and consistence; and there must be no contraction of the pelvis, or if contraction is present the head must have passed beyond it. In 11,064 cases of labor at the Budapest Lying-in Hospital, there were 115 forceps deliveries = 1.04 per cent. In 1895 the percentage was as low as 0.32 per cent. Of the 115 cases, 101 were primiparæ and only 14 multiparæ, so that the proportion is nearly 88

per cent. to 12 per cent. Von Walla (Monats. f. Geburts. u. Gynäk., B. 5, '97).

Forceps should not be applied until the head is under the brim, is well rotated, and the os is dilated. If there is any danger to mother or child it is then justifiable to operate in the absence of these three conditions. Fehling (Brit. Med. Jour., Aug. 20, '98).

We do not sanction the application of forceps to the head above the brim except for one indication, namely: when rupture of the uterus exists or is impending. In all other cases we decidedly prefer the elective version, for fear of causing a rupture in threatened cases or of increasing the tear in already-present ruptures. Again, we do not advocate the true high forceps application, because non-engagement of the head means either a malposition or a pelvis that is relatively or absolutely contracted.

In pelvic contractions, especially of a minor type, the mechanism of labor is different from that which takes place in normal ones. The head engages transversely instead of obliquely, and is hyperflexed. Since many pelvic contractions are antero-posterior, with compensating increase in the transverse diameter, it would appear that Nature conforms with what would be an ideal attempt on her part to overcome the dystocia. If the forceps is applied as usual along the sides of the pelvis, pressure is exerted from side to side; this, in our experience, is not compensated for by an overlapping of the bones, and the biparietal diameter of the head is not increased. According to direct observation, the pressure from side to side causes an increase in the biparietal diameter, which conforms to the contracted antero-posterior diameter, and in this fashion increases the pelvic contraction both relatively and absolutely. For this reason version is elected, for, under the above

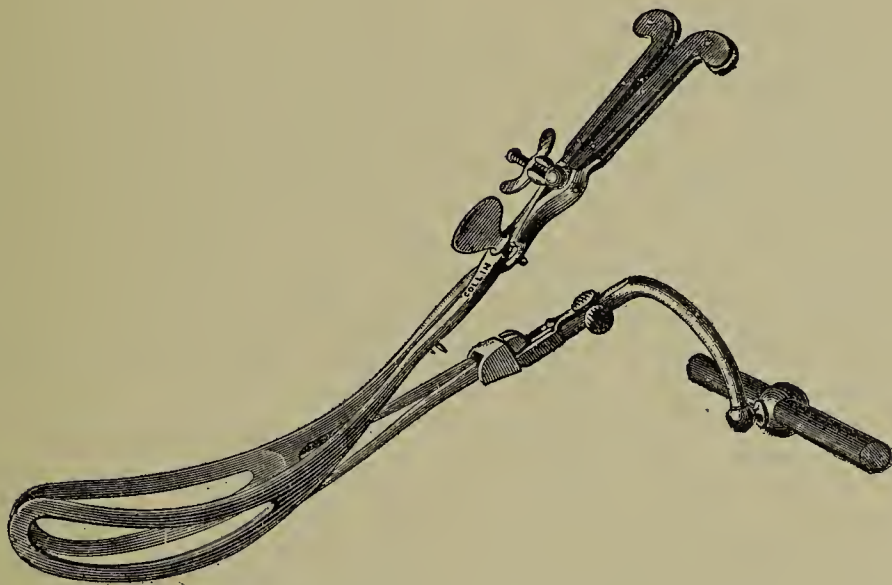
conditions, the after-coming head, descending, as it should, transversely, pressure is exercised by the antero-posterior contraction on the parietal bosses. This diminishes their diameter where the greatest contraction exists and affords compensatory side-to-side enlargement, which conforms to the enlarged transverse diameter. This, we believe, explains the superiority and safety for both mother and child of version over the high forceps application.

The ideal forceps of our day for all purposes is the true axis-traction forceps: that of Tarnier or Jewett. But its cost and the danger from its use are such as to make it an instrument eminently fitted for the expert only. In the ordinary forceps, the mechanism, as compared to that of the pelvis, does not come into operation, while, in the axis-traction forceps, the head, together with the body of the instrument, obtains great freedom in mobility. A further great advantage in its use applies forcibly to the child. With the ordinary forceps the more powerful the extraction force applied, the greater the compression force exercised upon the foetal skull, no matter how carefully done, no matter what amount of resistance force or material is placed between the handles at any point to lessen the compression power. Too much space between the handles absolutely insures a loose or unsteady application of the blades and consequently far greater predisposition to slipping. This is entirely overcome in the axis-traction instruments, through which no pressure is brought to bear directly on the head, since all extraction force is applied directly to and from the cross-rods. Finally it is remarkable with what ease apparently difficult cases are delivered by their use with a minimum force expended. The handles of the for-

ceps are an extremely useful guide as to the position of the head, and consequently an ever-guiding factor: a compass, as it were, as to the direction in which the force of the extraction is to be applied.

The indications for the use of the axis-traction instruments are in nowise different from those of the ordinary forceps. Nor does their application differ from that of the latter. It is only after they are locked and ready for use that the mechanism begins to differ. In their use the following rules must always be adhered to: The

to come into contact will at once influence the utility of the handle-tips as indices, for the tendency would then be to push the handles too rapidly forward and so give us a false conception of the true and ideal axis-traction; its effect would thus be spoiled and our energy rendered futile. Traction is then to be made and continued, the traction-handles carried farther and farther forward and upward until the head begins to crown. It is now advisable either to remove the forceps, or, if the head is to be delivered solely by the forceps, the operator stands to one side of the patient, and grasps



Tarnier's axis-traction forceps.

handles of the blades must be a guide as to the direction of traction, no matter what their position. The position of the blade in its relation to the pelvis must never be taken into consideration and certainly must never influence us as to the direction of our traction energy. The button on the traction-handle, or the point of junction of the traction-rods with traction cross-handle, must always be nearly in contact, just barely touching, and this relation must be maintained until the patient is practically delivered. To allow the two parts

both traction-rods and forceps-handles in one hand, while with the other he manages the perineum.

Certain objections to the use of the traction-forceps must, however, not be overlooked. Their cost is far greater; but when we consider the amount of energy saved and the diminished risk to both mother and child, this is compensated for. Their length is an objection in one direction only: the difficulty in finding a vessel large enough for sterilization. Their liability to slip in the hands of the inexperienced is far greater

than that of the ordinary forceps, and when this accident occurs the damage done to the maternal structures is far greater and deeper than the slipping of the ordinary instrument. Yet, in the hands of the expert, a slipping instrument is not very uncommon, and should at once suggest that a persistent use of this or any other instrument is fraught with considerable danger in a given case; other measures should be instituted in order to deliver.

[This point cannot be emphasized too strongly. A slipping forceps is either a misapplied forceps or else the instrument is contra-indicated by position or presentation. E. H. GRANDIN.]

Axis-traction forceps give a better chance to both mother and child. Theoretically the transverse grasp of the child's head is the right one, but practically it is often impossible. Robert Jardine (Brit. Med. Jour., Aug. 20, '98).

During the time from 1892 to 1895 there took place in the Copenhagen Royal Maternity Hospital 6294 confinements, 242 of which were terminated by forceps. The axis-traction forceps was used in 45 cases. The head should either be fixed or in the pelvic inlet before the forceps is applied; then, if properly performed, the operation is free from danger, but the mortality to the child is rather high—16 per cent. being still-born. Stadfeldt (Bibliothek for Laeger, '98).

The simplest, easiest, and most powerful method of applying axis-traction with the ordinary forceps is as follows: The patient being in the ordinary left lateral position, the blades are inserted so that the lock falls together. The handles are permitted to assume their natural position close to the symphysis pubes and pointing forward. They are allowed to remain during the whole process of extraction in this, the position that they naturally assume, pointing more and more forward as the head descends. To extract, the forceps is grasped at or above the lock with the left hand, and the hollow of the right hand is placed on the posterior surface of the extremities of the handles, so as

to be able to push with the right hand and pull with the left, by an action somewhat similar to that used in making a stroke with a paddle. Then, keeping both arms the whole time rigid and extended, the operator's chest, facing the patient, is placed in the desired line of traction, which, with the head at the brim, is a straight line passing from the patient's umbilicus through her coccyx, and reaction is made with the operator's back from the coccyx. T. Archibald Dukes (Brit. Med. Jour., Nov. 5, '98).

VERSION.—In version we recognize but one procedure, and that is the true internal version. This manœuvre is indicated in all cases when the presenting part fails to engage or when the presenting part is an abnormal one, such as occurs in abnormalities, as transverse positions, prolapsus funi, etc.; when hæmorrhages in placenta præviæ must be checked; and in cases in which, because of a malposed vertex, engagement fails. As pelvic contraction is the most frequent cause for the non-adaptation of the head, the limitations must be fixed as closely as possible. We are told that a $3\frac{3}{4}$ -inch pelvic inlet is the lowest limit in which version is warrantable. This calculation is purely arbitrary and uncertain. Such close figuring must depend on the *accoucheur* and is largely a matter of personal equation. It is again the question of passage-way and passenger. A head that is slightly larger than the pelvis can always be delivered by version no matter what the size of the pelvis is. If when version is to be performed the patient is placed in the Walcher position, a pretty large head can always be brought through a rather small pelvis, if the head be kept well flexed by suprapubic pressure and guided through the largest possible diameter.

Statistics from Leopold's clinic of version and extraction in narrow pelvis. From January, 1888, to May, 1892, there

were 6090 labors and 143 versions (2.3 per cent.); 16 of these were for placenta prævia, the patient being generally placed on her back and an anæsthetic given. Version was made by one or both feet. There was sometimes twisting of the cord. Extraction was made after version, except in 11 cases, in which spontaneous version as far as the umbilicus was awaited. Rosenthal (*Centralb. f. Gynäk.*, p. 125, '93).

Version with the patient in the prone position (face downward) has the following advantages: The outlet of the pelvis is directed above with the patient prone, giving the operator much more room for the insertion of the hand. The operator's hand and arm are in the position of pronation, giving a better use of the muscles and tactile sense. This posture widens and opens the uterus and vagina; the contraction-ring disappears in these cases. Risk of bruising the soft parts is less with the patient in this position. The patient has a pillow under the chest, her head turned to one side, while the operator may sit beside her, using either hand for version. By this posture two dangers are minimized: tearing the uterus from the vagina and air-embolism. Patients suffer less pain in this posture. Mensinga (*Centralb. f. Gynäk.*, No. 23, '96).

Fifty-nine cases of labor in contracted pelvis of the first and second degrees in which version was performed, and 215 cases in which the expectant plan of treatment was adopted. As far as the mother is concerned, the result is the same in both methods; for the child the expectant plan is much more favorable. The advantages of the expectant method were most apparent in the most difficult cases,—that is, where there was the greatest disproportion between the size of the foetal head and the capacity of the pelvis. In and of itself a contracted pelvis should never be regarded as an indication for version. Matseevsky (*St. Petersburg Univ. Thesis*, '98).

"Version by the vertex within the pelvis"—a direct conversion, by flexion, of a face presentation into a normal vertex position—may be accomplished as follows: The patient being under full

chloroform anæsthesia, the hand is passed carefully in the vulva, with the outside hand seizing the body of the child. In the entire absence of uterine contraction the chest is pushed as much away from the pelvic brim as possible from the point toward which the chin is pointing in the direction of the occiput: that is, pushing obliquely from behind forward. At the same time the fingers of the vaginal hand are pushed up alongside of the head in one or other of the oblique diameters of the pelvis, so that they can reach the suboccipital portion of the head. The thumb at the moment steadies the brow, and, with a slight lifting motion imparted to the whole head, it is caused to rotate on its axis as described, the chin passing upward above the sacro-ischiatic notch as the occiput is drawn down below the pubis. Flexion may be considerably hastened by pressing down the occiput by the outside hand as soon as the face is dislodged from its wrong position. Malcolm McLean (*Med. News*, July 28, 1900).

Version was performed 196 times in 6000 cases of labor at the Charité Polyclinic. The maternal mortality of these versions was 5, or 2.6 per cent. The cause of death in these cases was as follows: Eclampsia, 1; anæsthesia, 1; rupture of the uterus, 2; septic infection, 1. Death from rupture of the uterus or septic infection may properly, we think, be ascribed in some measure to the operation itself. The mortality from sepsis in these cases was 0.5 of 1 per cent. The foetal mortality was 48, or 24.5 per cent. The internal antero-posterior diameter of the pelvis must be 8 centimetres. A slight contraction in the true conjugate gives a better prognosis than a considerable lessening to $8\frac{3}{4}$, or 8 centimetres. When the cervix is fully dilated and the membranes have not ruptured or have but very recently ruptured, the chances are enhanced. Wolff (*Archiv f. Gynäk.*, B. lxii, H. 3, 1901).

When it is thought that a version in the Walcher position will not result in the delivery of child for any reason, such as a tetanized uterus, or when the

child cannot be turned, we are brought to consider symphysiotomy.

SYMPHYSIOTOMY.—This operation stands between version and the Cæsarean operation. Accepting the lowest limit for version as $3\frac{3}{4}$ inches and allowing about $\frac{3}{4}$ inch for the increase which the Walcher position gives us, this reduces the version limit to 3 inches, providing, of course, that the child is of average size. On the other hand, it is known that an absolute indication for the Cæsarean section is one in which practically no opening in the pelvic inlet exists—up to $2\frac{1}{2}$ inches, which will not even allow the passage of a mutilated child. Comparing these figures, we must agree that the field of limitation for a symphysiotomy is a very small one.

Marx contends that, from the standpoint of after-results (maternal lesions; large foetal death-rate), the operation is both dangerous and uncertain.

It cannot compare in its immediate and remote results with the modern Cæsarean section as done by the technique-perfect obstetrical surgeon. The indications for the operation have been stated as well as possible in a negative fashion above. Its contra-indications are: too much pelvic contraction or too large a child; ankylosis of either sacro-iliac joints; a dead or dying foetus; and sepsis, the last being an absolute contra-indication for its performance.

Operative technique of symphysiotomy:

Full dilatation of the cervix is to be secured if possible without risk to the child. The urethra and bladder should be held to one side with a sound. The initial incision is made a little above the subpubic arch and under the elevated clitoris. Then the left index finger is introduced within the vagina, against the posterior groove or ridge of the joint, up to the top and a narrow tenotomy-knife is passed with the point

close to the joint, up to within a half-inch of the top, and under the underlying soft tissues. A probe-pointed bistoury is substituted and the left index finger met with the probe over the top of the joint, and the blade is worked through the joint downward until separation is felt by the posterior finger. An assistant should press the mouth of the wound and tissues lying over the joint with a small piece of gauze. Delivery is to be accomplished with forceps, if possible, refraining from suprapubic pressure, aiming to deliver the head through the cervix without drawing the latter down below the symphysis. The bladder is to be held well to one side while pressing the pubic bones together. A small strip of gauze is then passed into the prepubic wound, and another against the cervix, after irrigating, leaving both pieces exposed for easy removal, having refrained from stitching cervix or perineum. A soft-rubber catheter is introduced into the bladder and left until sure the patient can voluntarily micturate.

During the year ending December, 1896, 95 patients, who had some pelvic abnormality, were confined in the Baudelocque Clinic. Fourteen cases were treated by symphysiotomy. In 7 instances the operation was done upon primiparæ, and in 7 upon multiparæ. All of the patients had rachitic pelves, and one had, in addition, luxation of the hip-joint. After the operation, 13 of the children were extracted by forceps and 1 by version. Results were: in 14 cases 12 mothers and 10 children recovered; 2 women and 4 children perished. Of the fatal cases among the mothers, 1 died of pneumonia, the other of streptococcic infection. The infant-mortality was largely due to aspiration-pneumonia. Pinard (*Annales de Gynéc.*, No. 47, '97).

Case in which symphysiotomy was performed without subsequent immobilizing measures and a perfectly satisfactory result obtained. The operation was performed in six minutes, Tarnier's forceps being used. The interpubic dilatation was seven centimetres. On the sixteenth day the patient was up and no pelvic

trouble ensued. M. Fieux (Gaz. Hebdom. de Méd., etc., Apr. 26, 1900).

Symphysiotomy is a useful operation within a limited range of pelvic contraction. It is suited to conditions in which only very little additional space is required for delivery. It is a valuable resource, therefore, in cases in which forceps unexpectedly prove inadequate. Axis-traction forceps with the aid of posture should always be tried before resorting to symphysiotomy. Its results would be much improved by restricting it to pelves with a conjugate of not less than 7.5 centimetres (3 inches) in simple flattening, or 9 centimetres (3 $\frac{1}{3}$ inches) in general contraction. Under equally favorable conditions its total mortality should be no greater than that of Cæsarean section. When the pelvic space permits, it should replace the Cæsarean operation in the presence of exhaustion. It may be elected primarily as an alternative of Cæsarean section when the operator can be assured that the degree of obstruction is well within its safe limit. Here the choice of operation is a matter of individual preference. Within its proper field symphysiotomy is better than Cæsarean section for an operator of little experience in abdominal surgery. Jewett (Amer. Medicine, Sept. 28, 1901).

The results of symphyseotomy may be either reunion of the bones or failure of reunion. The first can occur either as a result of the formation of connective tissue, or the union of cartilage or bone. If a bony reunion occurs, the pelvis may be permanently enlarged. If union does not occur, then, although the patient has more or less difficulty in walking and the inconveniences of a weak joint, nevertheless, subsequent births are very easy. The writer reports the case of a woman whose sixth child was born under his observation, and who had symphysiotomy done for the first child. Union had not occurred, and all subsequent births were easy. O. Ihl (Münch. med. Wochen., Apr. 7, 1903).

CÆSAREAN SECTION.—When for any reason the pelvis is rendered, by tumor or contraction, impassable for the un-

born child, dead or alive, we have an absolute indication for the performance of a Cæsarean section. The operation is indicated when there is a small pelvis with a large child, and, occasionally, when the maternal parts are not dilated and the patient's condition demands an immediate delivery, as, for instance, in placenta prævia or eclampsia. Again, carcinoma in a pregnant uterus at times justifies this operation plus a total hysterectomy; so does a severe case of antepartum sepsis. In the relative indications a living child, before the operation is undertaken, is a *sine qua non*.

The limitations for this operation have already been given; the advisability and the necessity of such must always rest with the operator.

The newest incision recommended by Fritsch is one that extends, not through the centre of the uterus, but transversely from one horn to the other, a little below and anterior to the fundus. Its advantages are the absence of important vessels above as compared to those in the lower uterine zone, the smaller wound, the ease of extraction, and the minimum danger from hernia of the abdomen, because of the higher situation of the external incision.

Technique of improved Cæsarean section: Strict antisepsis, four assistants; incision six inches, equal distance above and below umbilicus; seize uterus by left upper cornu, lift out, close incision partly above; place rubber tube around cervix, crossed but not tied, to be tightened as necessary. Incise uterus in median line, clamp bleeding vessels, avoid lower segment, incision four to five inches; if placenta is on anterior wall cut through it; if waters have not broken avoid soiling peritoneum. Introduce right hand, extract child by head if possible, if not by extremities; tie cord, divide, give child to assistant. Remove placenta if loose, if not insert sutures, but do not tie until placenta,

now having loosened, is removed. Cervix should be open; silk No. 4 for deep suture in uterus, finer sutures for superficial, one suture for each inch; peritoneum united by broad surfaces. All sutures tied, elastic ligature gradually removed; abdomen closed. Do not curette uterus. Woman allowed up in three weeks. H. G. Garrigues (Med. Rec., Feb. 1, '96).

Advantages of a transverse cut across the uterus at the fundus. In a recent operation the abdominal incision was made so that the navel was in the centre of the cut. Hernia is less common after a high incision. The placenta was quickly and easily extracted without bleeding; the child's legs were readily grasped; the womb quickly contracted, seven sutures closing it completely. The incision was about $3\frac{1}{8}$ inches long. Rapid recovery followed.

In operating upon the uterus the anatomy of the vessels is such that bleeding is best controlled when the uterus is incised transversely to its long axis, at the fundus. At the level of the tubes and ovaries the incision should be longitudinal to secure the vessels most readily. Fritsch (Centralb. f. Gynäk., No. 20, '97).

Though the transverse fundal incision bleeds but little, the foetus cannot always be extracted through it. The necessity for a vertical incision in addition causes so much damage to the uterus that it becomes safer to remove that organ than to close the double wound by sutures. Hence the conservative aim of the operator is completely defeated when a "Fritsch incision" will not allow of the extraction of the foetus. Steinthal (Centralb. f. Gynäk., No. 14, '98).

Sänger's conservative Cæsarean section performed 25 times. Of 18 patients that recovered 5 have already become pregnant again. Transverse incision along the fundus is disapproved; the wound in that case heals badly, as the vascular supply is interfered with by the sutures, secondary infection is very probable, and there is a greater chance of visceral adhesions than when the incision is longitudinal, facing the parietes. Most essential point in Cæsarean section is

accurate and safe union by suture of the longitudinal incision. Speedy union of the uterine wound is of first importance. This must be effected by three layers of sutures, so that the edges are kept together as closely as possible in spite of atony or contractions of the uterine muscular tissue. A deep layer of sutures should be passed, the ends of which are brought out into the uterine cavity and tied there against the decidua. Then a middle set, and afterward a more superficial set, are passed into the muscular coat and tied on the surface of the uterus. Everke (Wiener med. Woch., No. 51, '98).

Cæsarean section and symphysiotomy compared, observations being based on: (1) Leopold's results of 100 Cæsarean sections; (2) Pinard's results of 90 symphysiotomies; (3) personal results of both procedures at the Liège Maternity. With complete asepsis the mortality of Cæsarean section should not be over 5 per cent. It is a better operation than symphysiotomy on the grounds that (1) it is easier to perform, since no special instruments are required, only soft parts are cut through and these are exposed to view, any hæmorrhage is easy to control, and the operation is quickly finished, while in symphysiotomy much of the cut part is out of sight; after the point is severed there is still the difficult task of delivering the baby, for which purpose obstetrical forceps are generally needed, and serious tears of the soft parts are likely to result; (2) it is safer as regards hæmorrhage and injury to adjacent parts, just as safe as far as sepsis is concerned, and it has a less tedious convalescence with no fear of a loose pelvis, though there is slight fear of ventral hernia. Charles (L'Obstét., Nov. 15, '98).

Cæsarean section is not difficult to one who has had some experience in laparotomy. It is, however, dangerous if the least detail of antisepsis is omitted, and should never be done in women who have become septic. It is also dangerous through the possibility of atonic hæmorrhage, which may require ablation of the uterus.

Analysis of 170 operations gives a ma-

ternal mortality of 6.41 per cent., and a foetal mortality of 5.57 per cent. Bar (L'Obstét., May 15, '99).

Cæsarean section personally performed in 14 cases without mortality. The indications which render it justifiable vary in accordance with whether the mother is, or is not, already infected with sepsis; exhausted by prolonged labor, or by previous severe efforts at extraction of the child; or the subject of serious complicating disease. When her vitality is lowered by any of these causes, the maternal death-rate of the Cæsarean section is so enormous that is justifiable only for the absolute indication: *i.e.*, when the child cannot be extracted by any other method. In the absence of such unfavorable conditions, and under circumstances which render good operating possible, the Cæsarean section is no more dangerous to the mother than any other simple abdominal operation; it is therefore (a) the operation of choice in cases already at term in which the ordinary intrapelvic operations are inefficient; and (b) may even be chosen in suitable cases in preference to the induction of premature labor, on account of its greater safety to foetal life. Edward Reynolds (Obstetrics, Jan., 1900).

VAGINAL CÆSAREAN SECTION, one of the newest of the various obstetrical operations, is one whose indications are: normal size of child and pelvis; pregnancy at or near term; malignant growth of uterus or other obstructing tumor which renders its delivery safe through the vagina and whose persistent presence renders its removal justifiable. Under these conditions the vaginal Cæsarean hysterectomy has been recommended by Dührssen. The technique of the operation is as follows: After thorough asepsis, the anterior and posterior *cul-de-sacs* are dissected up and the arteries and bases of the broad ligaments either angiotribeed or tied off. The cervix and lower uterine zones are now split up on two to four sides extending above the internal ring. The

membranes are then ruptured, the child is delivered, the placenta extracted, and the hysterectomy finished "*lege artis*" as in the non-pregnant woman.

Less dangerous than the classical Cæsarean section is an operation by which, in spite of closure of the cervix, and without opening the peritoneum, a living child may be delivered by the vagina. The portio is exposed by a large speculum, and, sagittal openings having been made in the anterior and posterior vaginal vaults, the bladder and vesical fold of peritoneum and that of Douglas's pouch are detached from the cervix and lower segment of the uterus, which are then divided in the median plane. After the bleeding has been arrested by ligatures, the hand is introduced and the child extracted. The operation is indicated when, with an undilatable cervix, the mother's life is imperiled by circumstances which may be improved, or set aside, by emptying the uterus; for example, in severe eclampsia or uræmia; in cases of serious internal hæmorrhage from a normally-situated, but prematurely-displaced, placenta; in grave pulmonary or cardiac disease; in the interests of the child, when the condition of the mother is expected to prove rapidly fatal; and, finally, in pathological conditions of the cervix (stenosis, rigidity, myoma, carcinoma) or of the lower segment of the womb (pathological bulging). In new growths of the cervix the operation may be supplemented by vaginal hysterectomy, which, directly after delivery, can be performed in a few minutes, by Doven's method. Dührssen (Berl. klin. Woch., p. 530, '96).

There are on record over 60 cases of vaginal Cæsarean section. The method should take the place of ventral Cæsarean section in nearly every case where the soft parts form the obstacle to delivery, or where a narrow pelvis can be excluded. Stamm (Medical News, Feb. 20, 1904).

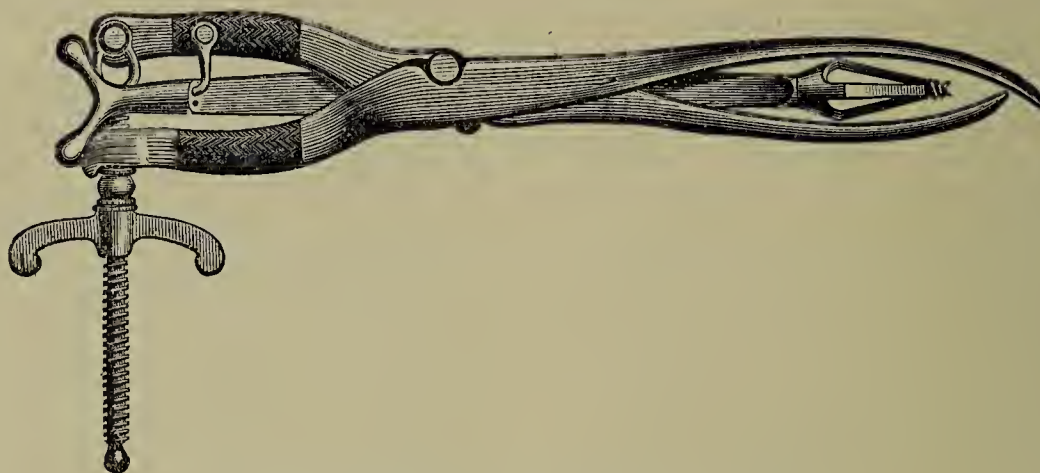
Surgical Measures Indicated in Foetal Obstruction.—These are all destructive to the child; they are, however, conservative, since they are preservative to the

mother. In actual practice our first duty is to the mother, and under no condition should danger to the child influence the *accoucheur* in increasing the danger to the mother, unless, of course, the full consent of both parents is obtained. Where mother and baby have equal chances, those chances should be well weighed and operative influence estimated. In all difficult and prolonged labor cases in which many operators have examined and many instruments have been used, and operations have been attempted and failed, the child as a result of these prolonged, fruitless, and severe manipulations has often suf-

breech. 4. Total embryotomy. 5. Decapitation. 6. Cleidotomy.

CRANIOCLAST.—The use of the cranioclast we have given up entirely, since the instrument, at least in our hands in difficult cases, has repeatedly pulled out, making it a sort of osteoclast.

BASIOTRIBE.—In the place of the cranioclast, the basiotribe of Tarnier has proved a wonderfully successful and staunch instrument. When once it is in place, it holds on "like grim death." Its application is somewhat complicated, since its three distinct parts act in unison, the central part the perforator, on each side the heavy cephalotribe-like



Tarnier's basiotribe. (*Grandin and Jarman.*)

fered so severely as to have been nearly or already sacrificed. In such cases, a deliberate perforation ought always to hold preference. The perforator is an instrument still possessed of a large field of application. It is our rule to perforate or dismember in all cases in which the child is suffering very severely or is dead, no matter what its position in the pelvis is, except where the head can with safety to the mother be delivered by instrumental or manual extraction. We therefore have at our disposal the following operations: 1. Basiotripsy. 2. Cranioclast to the head. 3. Cranioclast to the

blades gripping, not alone the head, but the base of the skull.

CRANIOCLAST TO BREECH.—This is an operation original with Simon Marx. It is indicated in bad cases of breech impaction in any part of the pelvic tract when it is impossible to break up the wedge, either by pulling down a foot or using firm abdominal pressure to cause the breech to emerge. This class of cases is met with in prolonged labors with tetanus uteri. The anus is enlarged by means of scissors, one blade is introduced into the anus, the other grasping the sacrum high up and the compression-

screw sent home. A good purchase is then obtained and the breech delivered.

TOTAL EMBRYOTOMY is rarely performed, since one or the other of the destructive operations will answer.

DECAPITATION.—In impacted transverse or shoulder presentations a deliberate decapitation will nearly always precede an embryotomy if the latter operation is at all necessary. But when after decapitation it is impossible because of spasm to deliver, dismemberment is in order; or, if the child be macerated, it is also indicated, since a purchase on one or both feet will result in their being torn off. In locked twins it may become necessary to decapitate one or both children.

CLEIDOTOMY, or cutting through one or both clavicles, is one of the new destructive operations. It is indicated in impacted shoulders either in case of spastic contraction or when the shoulders are abnormally developed and large. Thus, occasionally, after delivering the head, it is impossible to deliver the trunk because of a pair of enormous shoulders. The child promptly dies, and brute force would only succeed in making frightful lesions of the genital tract. If now a pair of stout scissors are introduced and the clavicles are deliberately cut through, the chest instantly collapses, its diameter is diminished, and speedy delivery follows.

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PELLETIERINE.—Pelletierine, or punicine, is the alkaloid obtained from the root-bark of the pomegranate (*Punica granatum*, L.), or granatum, U. S. P. As found in the shops it consists of a mixture of pelletierine and isopelletierine. It occurs as a colorless, oily liquid, of aromatic taste and odor, and is solu-

ble in 20 parts of water, and more soluble in chloroform, alcohol, and ether. It readily forms salts with the acids, of which the tannate is most commonly used. The tannate occurs as a yellowish or grayish-brown, hygroscopical powder, having a slight astringent taste. It is soluble in 80 parts of alcohol, in 700 parts of water, and in warm dilute acids. Tanret's pelletierine is a syrupy solution, sold in bottles, each containing one dose.

The officinal granatum is seldom used in the crude form. A decoction (4 to 16) in doses of 4 to 6 ounces, or fluid extract in doses of 1 to 2 drachms, is sometimes employed, but neither is officinal.

Physiological Action and Therapeutics.—Pomegranate is a powerful astringent, and a decoction, flavored with aromatics, is useful in pharyngitis and as an injection in urethritis. Coronedi has found that pelletierine, in poisonous doses, paralyzes the peripheral ends of the motor nerves very much in the same way as curare does, without influencing contractility or destroying sensibility, and acts chiefly on the lower limbs, in which cramps may precede the loss of power. Pelletierine may also cause nausea and vomiting.

Autopsy made on a man, 34 years of age, who had died in a comatose condition some hours after having taken a dose of 7½ grains of sulphate of pelletierine. Strychnine poisoning was suspected, but sulphate of pelletierine was found in the viscera. The patient was an epileptic, and epilepsy is personally considered contra-indication to the use of pelletierine. The sulphate of pelletierine is much more dangerous than the tannate, and it is recommended to administer tannin at the same time as the sulphate of pelletierine. Crolas and Boyer (Lyon Méd., July 3, '98).

A decoction of pomegranate was formerly used in serous diarrhœa and profuse sweats and in dysentery, but on ac-

count of its disagreeable taste and effect upon the stomach it is no longer used.

Dujardin-Beaumetz has successfully used pomegranate in Ménière's disease. According to Galezowski, pelletierine is of service in paralysis of the third and sixth nerves.

The special use of this drug is for the destruction of tape-worms. In tropical countries the powdered bark is used in doses of $\frac{1}{2}$ to $1\frac{1}{2}$ drachms. The decoction (made by soaking 2 ounces of the bark in 2 pints of water for twenty-four hours, and then boiling down to a pint) is a nauseous dose, but generally efficacious; a wineglassful of this decoction is taken every hour until the whole pint is taken. Generally purging and vomiting follow, but, should purging not occur, castor-oil or other good purge should be used to expel the worm. A previous fast of twelve hours is necessary, whatever form of this drug is used.

Pelletierine tannate is given in doses of 3 to 15 grains, in 1 ounce of water, followed in two hours by a brisk purge. As serious paralytic symptoms have ensued after the ingestion of 5 grains by a susceptible woman, not more than this amount should be given.

PEMPHIGUS.

Definition.—This is a comparatively rare skin affection characterized by the formation of blebs, or bullæ, containing a serous or sero-purulent fluid, and often attended by constitutional disorders.

Varieties.—Three main varieties of pemphigus are recognized: (1) *pemphigus vulgaris*, which may be acute or chronic and usually terminates fatally; (2) *pemphigus foliaceus*, a malignant form, in which the bullæ are purulent from the start, rapidly increase, do not heal, and are replaced by lamellæ, or scales; and (3) *pemphigus neonatorum*,

an acute infectious form observed in infants at birth or soon after birth and usually ending in recovery.

Symptoms.—PEMPHIGUS VULGARIS.—There usually appear a few discrete bullæ about the face which gradually invade the entire body, but especially the trunk and upper extremities. The bullæ contain a serous liquid which in some cases becomes purulent and hæmorrhagic. Itching and burning are experienced, accompanied by slight prostration, anorexia, and, occasionally, slight fever. The disease remains stationary some weeks, and then suddenly assumes a state of exacerbation, during which more bullæ are developed or older ones become greatly increased in size, and confluent. Successive attacks occur, weeks or months apart, each being attended by sharper manifestations, local and general. The oral cavity, the eyes, the genitalia, and the respiratory and gastro-intestinal tracts are gradually invaded, and the patient sinks into a cachectic condition from which he does not rally. This constitutes what is often termed the chronic, or slow, form.

In the acute form the symptoms outlined merely occur in closer succession and are grave from the start, chills, high fever, delirium, albuminuria, etc., following in rapid succession. The eruption, however, is usually limited to the upper part of the body and is discrete (Bazin). Death occurs in from ten days to two weeks after the onset. It greatly resembles a contagious form, which, however, is much more rare.

PEMPHIGUS FOLIACEUS.—In this form the bullæ may become developed as in the preceding variety, but they are apt to be flattened. They contain a small quantity of foul-smelling liquid or pus and rupture easily. Other bullæ forming around the older ones, the entire sur-

face becomes covered; the underlying skin, failing to heal, presents a raw and red appearance, recalling a superficial burn (Hebra). Oval or round scales or leaf-like crusts (whence the name) are formed over the older bullæ, and the skin itself appears scaly, retracted, creased, and ulcerated in various spots. Painful itching and smarting, followed by various complications,—enteritis, pulmonary congestion, etc.,—give rise to considerable suffering, and the patient gradually sinks in marasmus if he is not carried off by one of these intercurrent disorders.

PEMPHIGUS NEONATORUM is seldom, if ever, present at birth, and does not develop before the third day, rarely later than the fourteenth. The eruption, unless complications occur, is not accompanied by fever, and consists of round or oval blisters upon apparently normal skin. These blisters are at first transparent, slightly yellowish, and are surrounded by a reddish areola, which in rare cases invades the surrounding tissue. The blisters usually rupture, and in severe cases give rise to an appearance resembling that of pemphigus foliaceus of adults. After the blisters have broken a raw surface is left, covered by membrane; but, unlike pemphigus foliaceus, the skin beneath rapidly recovers. This disease is infectious, and infants are, as a rule, either infected by the physician or the midwife, who may be suffering from the disease (Luithlen). It occasionally proves fatal, the appearance of thrush and intestinal disorders being unfavorable signs in this connection.

Etiology and Pathology.—Pemphigus is believed by many modern observers to be the active manifestation of a neurosis. It is often met with in neurotic or hysterical subjects, chronic drunkards, and syphilitics. In a case of pemphi-

gus foliaceus Schlesinger found syringomyelia to have been present. On the other hand, there is considerable evidence in favor of the view that it is due to a special micro-organism.

Demme, Claessen, Bullock, and, more recently, Whipham found in the contents of the bullæ a diplococcus which grew as a pure culture outside the body, and caused death when injected into guinea-pigs. Whipham obtained pure culture from the blood of animals thus infected and inoculated others, which after death showed typical manifestations in the lungs.

Treatment.—Arsenic in gradually-increasing doses is usually preferred in pemphigus vulgaris, given until the physiological effects are noted. Small doses of strychnine given hypodermically are also valuable. Tonics are important aids and the patient should receive food rich in proteids, while the emunctories, the intestinal and urinary systems, should be kept active if a tendency to torpidity is apparent. Warm baths, especially bran-baths, are soothing and tend to relieve the pruritus and burning sensation experienced. Externally, oxide of zinc and boric-acid ointment are useful; when the burning is severe, an effective remedy sometimes is a solution of acetate of lead in linseed-oil.

PENIS AND TESTICLES, DISEASES AND INJURIES OF.

Diseases of the Penis.

Anomalies.—Anomalies of the penis are so extremely rare that they possess but little clinical significance. Such patients are often mentally deficient and so afflicted with other extensive malformations and deformities that they rarely survive for any great length of time.

ABSENCE OF THE PENIS.—This is the rarest of anomalies of the penis, and,

with the exception of a case reported by Demarquay, practically unknown except in very young children. The urethra may open into the rectum, by the margin of the external sphincter, or in the perineum. It is highly probable that some of the cases of absence of the organ are really instances of rudimentary or concealed penis.

CONCEALED PENIS.—A few cases have been reported in which the penis was small, undeveloped, and concealed beneath the skin near its normal situation. Urine was passed through a fistulous opening in several cases; in others no opening could be found, and retention of urine followed.

Treatment.—In every case of apparent absence the organ should be carefully searched for, freed by incisions, and by a plastic operation covered by skin taken from the neighboring parts.

RUDIMENTARY DEVELOPMENT.—Rudimentary penis, especially when complicated with cryptorchism or other abnormalities, is not uncommon. Men of middle age with genitalia no more developed than children of five or six years are frequently seen. Many of these cases, however, are capable of marital relations, and have successfully impregnated women, although impotence is the rule.

Treatment.—In many instances but little can be done for the relief of this condition. When seen in early life, preputial adhesion or a tight phimosis should be relieved. In the young adult a suction-apparatus has been recommended and employed with considerable success. A bell-jar fitting tight around the root of the penis is exhausted by a rubber bulb, thus causing congestion and distension of the erectile tissue. Such treatment should be carried out over a long period.

HYPERTROPHY OF THE PENIS.—The

size of the penis bears no relation to the size of the individual. In imbeciles and dwarfs it may be enormous, while in the well developed it may be quite small. Hypertrophy of the penis may render coitus impossible, and may be a source of danger by predisposing the patient to abrasions and fissures through which he may become inoculated with venereal poison.

DOUBLE PENIS.—This anomaly has been noted in several authentic instances. The two organs are usually placed side by side, and other evidences of monstrosity generally exist (supernumerary limb). In several of the cases the function of both organs was perfect, as regards urination, capability of erection, and seminal emission.

TORSION OF THE PENIS.—Twisting of the penis on its long axis so that the frænum is uppermost is most uncommon. Urination and ejaculation of semen are, as a rule, not interfered with; hence no treatment is required.

ADHERENT PENIS.—Through nearly its entire length the penis may be adherent to the scrotum,—of course, interfering with its function.

Treatment.—Such a deformity should be operated upon as soon as discovered in order to prevent stunting or incurvation of the organ. The membranous septum should be divided along its entire length, and the raw surface remaining closed by sutures or by a plastic operation.

Anomalies of the Prepuce.—The prepuce may be absent, redundant, or incompletely developed. Absence of the foreskin calls for no treatment, nor does incomplete development unless complicated by phimosis or an irritated or inflamed glans penis.

ADHERENT PREPUCE is often responsible for many reflex phenomena of a

convulsive or paralytic type and stunted growth of the penis. Its treatment can be readily carried out, in most instances, by relieving the phimosis either by performing circumcision or by stretching the præputial orifice. The raw surfaces resulting from the latter procedure should be smeared with an ointment composed of a drachm of boric acid to the ounce of carbolized cosmolin. The glans penis should be washed daily with mild antiseptic solutions and the ointment reapplied. As cellulitis followed by death has resulted from this stripping process, at least ordinary antiseptic precautions should be observed.

Occlusion or Obliteration of the præputial orifice may not be detected immediately after birth, but the appearance of a tumor at the end of the penis due to the accumulation of urine will soon call attention to the trouble. The treatment of this condition is circumcision.

Short Frænum.—This congenital deformity occasionally interferes with complete erection, turning the orifice of the meatus down, and not only preventing ejaculation in the proper direction, but rendering coitus painful or impossible.

Treatment.—The base of the frænum should be divided by a narrow bistoury, and the prepuce kept retracted until healing is complete.

Phimosis.—A preternatural elongation of the prepuce with a contracted orifice rendering it impossible to uncover the glans penis is termed phimosis. The præputial orifice may be so small that a probe cannot be made to pass ("pin-point" orifice).

Varieties.—1. Congenital (always permanent). 2. Acquired: inflammatory (usually temporary); cicatricial (always permanent).

Congenital.—The prepuce begins as a fold of tissue about the third month of

foetal life; as it grows forward, the inner surface of the foreskin becomes adherent to the glans penis. During the first year of life the prepuce generally becomes loosened; should this not occur a true phimosis results.

Acquired.—The acquired may be either inflammatory or cicatricial. The inflammatory—balanoposthitis—usually occurs as a result of various forms of ulceration about the glans and prepuce. Cicatricial contraction results from the healing of ulcers, injuries, and bad circumcisions—the mucous membrane being left too long, thus permitting the scar to slip in front of the corona glandis.

Symptoms.—Moderate phimosis may exist without giving rise to symptoms. However, as a result of the decomposition of the retained smegma and urine and obstruction to the flow of urine, symptoms may develop which are exceedingly distressing and may permanently impair the general health. In children there are symptoms which often simulate vesical calculus: balanitis, heat, itching, pain at the head of the penis, frequent erections, pain on urination, frequency of micturition, dysuria, or incontinence. Under the remote effects may be considered malnutrition, choreic movements, paralysis, convulsions, prolapse of the rectum, hernia, atony of the bladder, the latter conditions being most frequently seen when there is marked contraction of the præputial orifice requiring severe straining efforts to be made during urination. In older children the condition is apt to give rise to priapism, and is undoubtedly the cause of masturbation and often an arrest of development of the penis.

After puberty and later, functional sexual troubles begin: erections occasion intense pain, the repeated attacks of

balanoposthitis reflexly predispose to nocturnal emissions, and coitus is painful or impossible.

When phimosis is unrelieved, the irritation of chronic balanoposthitis is the frequent cause of fissures, vegetations, and adhesions, in later life, and, in consequence of it, cancer is liable to occur.

Phimosis is a strong predisposing factor of penile cancer. Direct contagion seems to be the cause in some instances. Edward Martin (*Jour. of Cut. and Genito-Urin. Dis.*, Mar., '95).

It is not uncommon in long-standing cases of phimosis to find one or more calculi beneath the prepuce due to decomposition of the urinary salts. These calculi may be very small, but, however, may weigh several ounces.

Treatment.—Permanent phimosis, whether congenital or acquired, should always be treated by operation (circumcision). In the majority of instances congenital phimosis is spontaneously relieved. If the epithelial separation is not complete at birth, it may be quickly accomplished by the flat end of a probe, the raw surface left being covered with carbolized oxide-of-zinc ointment to prevent adhesions.

For temporary phimosis following inflammations and ulcerations subpræputial injections of Castile soap and hot water with a flat-nozzled syringe should be made twice daily, followed by the use of a lead-water-and-*laudanum* solution to which $\frac{1}{2}$ drachm of carbolic acid has been added to every 6 ounces. During the day the entire organ should be surrounded with lead-water and *laudanum*.

CIRCUMCISION.—Operation for the removal of the prepuce is indicated in chronic balanoposthitis with or without adhesions; certain cases of paraphimosis; to prevent masturbation; when the sexual orgasm is too early induced; to prevent gangrene of the glans penis con-

secutive to concealed ulceration; tuberculosis, and epithelioma.

New operation for phimosis, which can only be performed upon a normal, undiseased foreskin. Two incisions are made in the outer layer of the prepuce from one point at its edge, at a right angle to each other, as far as the corona glandis. As the foreskin is retracted, a denuded surface, oblong in shape, is seen, which is sutured to form a transverse line. Then the wide prepuce can be replaced over the glans as a protection. The technique is described and illustrated by diagrams. Phimosis cannot recur. This operation is only possible when the two layers of the prepuce are freely movable. Schoffer (*Centralb. f. Chir.*, June 29, 1901).

The usual antiseptic precautions are to be observed. With a pair of Ricord's phimosis-forceps the prepuce is grasped just at the corona glandis, parallel to its obliquity, and the prepuce is drawn in front of the glans as the forceps are locked. With a sharp-pointed straight bistoury the prepuce is divided with a sawing motion through the fenestra of the forceps. The skin now retracts behind the corona, exposing the inner or mucous layer of the prepuce still covering the glans. With a fine pair of scissors this is now divided in the median line to the corona. The two flaps remaining are then cut off close to the edge of the corona, leaving just sufficient tissue to hold a stitch. This will prevent the scar from slipping in front of the corona, thus causing a return of the phimosis. The frænal artery is now twisted or ligated with fine catgut, and the wound closed with fine black silk sutures. The first suture should be introduced at the frænum, the second at the dorsum, and two or three at intervening points on both sides; care should be taken that the raw surfaces be accurately approximated. A gauze bandage wet with a 25-per-cent.-boroglyceride solution should be applied

as a dressing. The bandage should be removed daily or every other day and the parts irrigated with 1 to 5000 nitrate-of-silver solution, and the boroglyceride dressing be applied.

When the penis is large, the operation may be done without the aid of forceps. A grooved director is introduced between the glans and the prepuce exactly in the median line, and on it, both layers of the prepuce are divided at one time by scissors to the corona. An assistant with dissecting forceps makes slight traction upon the triangular flaps remaining, and with curved scissors the skin and mucous membrane are cut off close to the line of the corona as above described.

Paraphimosis.—Inability to draw forward a retracted prepuce from behind the corona glandis may be caused by gonorrhœal balanoposthitis, chancres, chancroids, violent coitus, retraction of a tight prepuce, and any lesion of the glans or prepuce attended by swelling.

Symptoms.—As a result of the mechanical constriction of the præputial orifice, the glans penis rapidly swells, and becomes red and tense. Over and behind the coronary sulcus is a brawny swelling, which represents the mucous layer of the prepuce. Behind this another deep groove is seen, which corresponds to the præputial orifice, the seat of constriction. If left untreated, gangrene may result; or it may remain chronic, the retracted tissue becoming inelastic and indurated.

Treatment.—When paraphimosis is of sudden development and not dependent upon œdema consecutive to ulcerative lesions, reduction should be attempted immediately. The organ should be rendered bloodless either by gentle pressure or by the application of a small finger bandage. The parts are then greased well with sweet oil, the index and middle

fingers of each hand are crossed behind the glans penis, and with the thumbs attempt should be made to force the glans penis through the swollen tissue. When reduction is possible, the foreskin will slip forward with a characteristic snap. Failing in this, the præputial orifice is to be divided in the second groove on the dorsum with a curved sharp-pointed bistoury, cutting from within outward. Hot compresses should be applied for several hours to restore the circulation and favor the absorption of the œdema.

When paraphimosis is consecutive to ulceration and in no danger of causing gangrene, hot compresses or lead-water should be applied and at the same time the original lesion should be treated. These cases usually reduce spontaneously. If not, they should be treated as above described. Should the brawny œdema of the reduced tissues persist for several weeks or months, circumcision is to be recommended.

Injuries of the Penis.—**CONTUSION.**—Severe contusions of the penis occasion so intense an ecchymosis and œdema as to simulate rapid gangrene. Small circumscribed tumors form, most prominent during erection, and result from the rupture of vessels in the cavernous bodies, forming hæmatomata. When the urethra is involved, blood will escape from the meatus, and inflammatory phenomena quickly develop.

Treatment.—Contusion may be treated by rest, elevation, and the application of hot antiseptic compresses. If the symptoms are progressive, an incision should be made under strict antiseptic precautions and the bleeding vessels ligated. Emphysema is a serious symptom and necessitates free incisions, as does the first sign of suppuration; thorough drainage in this instance is essential. Extensive swelling and discoloration

should not occasion alarm unless there has been rupture of the urethra or the cavernous or spongy bodies.

INCISED WOUNDS.—Incised wounds, when slight, heal quickly when closed early. If, however, they are deep and the erectile tissue is involved, free hæmorrhage results, and the possible loss of the power of erection in the part anterior to the wound. When the penis is completely divided hæmorrhage may be so serious as to cause death unless quickly controlled.

Treatment.—All hæmorrhage is to be controlled by ligature, the venous oozing is checked by the simple apposition of the cut surfaces. If it cannot be so controlled, a hard-rubber catheter may be introduced into the urethra and a tight roller-bandage applied. Such remedies as have a tendency to prevent erections should be administered internally. No matter how extensive the wound, an effort should always be made to suture together a divided penis.

When the urethra is divided, it should be sutured, and a catheter introduced through the urethra into the bladder to prevent the formation of a urinary fistula; it should be removed at the end of the seventh day.

PUNCTURED WOUNDS.—Like punctured wounds elsewhere in the body, infection is likely, and a severe inflammation usually results.

Treatment.—Whenever possible, all punctured wounds should be converted into incised wounds in order to prevent infection and permit of drainage from the bottom.

CONTUSED AND LACERATED WOUNDS.—These wounds are dangerous only when the tissues are devitalized to a great extent or the urethra involved. When extensive they are liable to be fol-

lowed by loss of erectile power or distortion of the penis.

Treatment.—These wounds require treatment that will control the resulting inflammation. When the urethra is involved, a catheter should be passed through into the bladder and maintained in place for a week or ten days. Occasionally it may be impossible to pass an instrument from before backward. Under such circumstances it will be necessary to open the urethra behind the injury and pass the catheter from behind forward.

GUNSHOT WOUNDS.—Gunshot wounds simulate contused and lacerated wounds and are subject to the same complications. The bullet should always be removed.

FRACTURE OF THE PENIS.—This injury may happen during coitus, and from traumatism calculated to “break” a painful chordee. The injury consists in a laceration of the corpora cavernosa, and is followed by an extensive hæmorrhage into the subcutaneous tissues and great swelling. The erection immediately disappears, and the part anterior to the injury is unnaturally movable. When the urethra is involved there is an escape of blood from the meatus, and infection is extremely likely to occur. After such an injury the power of erection in the part anterior to the injury is usually lost; this may interfere with coitus and cause permanent impotence.

Treatment.—Fracture of the penis may be treated either conservatively or radically. The injured organ may be surrounded with lead-water-and-laudanum solution and kept firmly pressed against the abdominal wall by means of a bandage. The penis may be incised, the clots turned out, the bleeding vessels ligated, and the rent in the capsule closed by sutures. A permanent catheter should be

introduced and the entire penis covered with an antiseptic dressing held in place by a firm roller-bandage. The catheter should be removed at the end of forty-eight hours and a new dressing applied. Erections must be prevented by the free use of bromide of sodium or potassium and by keeping the bowels regular.

DISLOCATION OF THE PENIS.—This injury results from a severe blow to the penis when in a flaccid state, tearing the subcutaneous cellular tissue at its root, forcing the organ to become incarcerated in the subcutaneous tissue of the abdomen, scrotum, perineum, or thigh. The mucous layer of the prepuce, which should prevent this accident, usually gives way along the line of the coronary sulcus. The urethra is occasionally ruptured in the perineum.

There is intense pain, extensive subcutaneous hæmorrhage, and also bleeding from the meatus. Occasionally there is urinary extravasation and abnormal position of the root of the penis.

Treatment.—The penis should be returned to its normal position by traction when possible, or by means of a hook introduced into the meatus. Failing in this, it is proper to make incisions to permit of sufficient manipulation that the organ can be reduced. Extravasations of urine should be opened and drained, and an external urethrotomy or perineal section performed. Unless reduced early, adhesions may form from which it is not always easy to free the dislocated organ.

Inflammatory Affections of the Penis.
—**PENITIS.**—An inflammation of the penis, which may be acute and due to gonorrhœal folliculitis, erysipelas, rupture of the urethra with urinary extravasation, and wounds; or chronic, due either to the rheumatic or gouty diathesis or to syphilis. It is also ascribed to old

areas of blood-extravasation which have undergone organization.

When superficial, all the signs of inflammation are present associated with a rapid, inflammatory œdema. In the circumscribed variety the inflammatory symptoms are local and followed by the formation of a tumor, which finally softens, indicating pus-formation. The diffuse form is rapidly followed by gangrene.

The chronic variety is characterized by slow-growing, painless areas of induration scattered through the cavernous bodies. The erect penis is bent at the seat of induration, and erections are usually incomplete in that part anterior to the node.

Treatment.—In the acute diffuse variety early free and multiple incisions are necessary to prevent gangrene; drainage should be provided for, and antiseptics maintained. Where gangrene has already developed, the treatment should be that appropriate for gangrene in other parts of the body. When spreading slowly, hot antiseptic fomentations should be applied until the slough separates, and the remaining simple ulcer treated on general principles. In the rapid-spreading form of gangrene the sloughs should be cut away, and the raw surface left touched with the thermocautery. Circumscribed abscesses of the cavernous bodies should be opened early and thoroughly drained. The function of the penis may be somewhat interfered with after healing.

In the chronic form of the trouble little can be done. Iodide of potassium and other remedies indicated in rheumatism and gout should be administered internally, while locally mercurial or ichthyol ointment should be applied. Occasionally pressure with a fine-rubber bandage will bring about a cure.

LYMPHANGITIS.—Lymphangitis is always secondary to peripheral inflammation and may be simple or venereal in origin. The vessels feel like fine wires beneath the skin and usually lead to the nearest lymph-glands, which will be found enlarged. Occasionally small nodules form which may soften, break down, and ulcerate, leaving small fistulæ, which may persist for a long time. The condition must be distinguished from phlebitis by the smallness of the vessels, the fact that they are not in the median line, and the much lessened œdema.

Treatment.—Rest, elevation, and the application of evaporating lotions. When they are dilated without inflammation, pressure or the use of mercurial ointment may cause them to disappear, otherwise excision or a seton is required to bring about a cure.

PHLEBITIS.—This is a rather uncommon condition and is usually secondary to diseases of the penis or urethra. There is usually considerable pain and œdema, and a quite large indurated cord is felt along the dorsum of the penis exactly in the median line. Occasionally suppuration takes place.

Treatment.—Rest, elevation, and the use of evaporating lotions or mercurial ointment are usually sufficient.

VARICOSE VEINS.—Varicose conditions of the veins is not uncommon and is of but little clinical significance, although they may occasionally be accompanied by a loss of power of erection. When large enough to prevent coitus, they may be ligated or excised.

BALANITIS AND POSTHITIS.—Balanitis is an inflammation of the mucous surface of the glans penis, and posthitis an inflammation of the mucous layer of the prepuce. As the two surfaces are usually attacked simultaneously the term balanoposthitis is used.

The predisposing cause is a redundant or phimotic foreskin. Because of the retained smegma and urine, the two mucous surfaces are kept constantly moist; they become more or less macerated, offering conditions most favorable for the development of micro-organisms. Diabetes is also said to be a predisposing cause. The exciting causes are irritations, abrasions, contact with endometrial discharges, and chancre, chancroid, gonorrhœa, and diphtheria.

Symptoms.—In the mild forms there is usually some burning and itching, the mucous membrane is red, somewhat thickened, and a sero-sanious pus escapes from beneath the foreskin or covers the surfaces as a milky secretion from which a very offensive odor is emitted. When the inflammation is more intense, superficial erosions and ulcers are seen about the corona. Croupous and diphtheritic varieties of inflammations have been observed, the mucous layers being covered with a membranous coating; it is closely adherent, and the attempt to strip it off is followed by hæmorrhage. Among the complications are phimosis, paraphimosis, lymphangitis, and gangrene.

Treatment.—Balanoposthitis may be promptly relieved by cleanliness. The prepuce should be gently retracted, the parts washed freely with Castile soap and warm water twice daily, carefully dried, and dusted with equal parts of bismuth, boric acid, and calomel. It is usually a good plan to interpose a piece of gauze or lint, so that the two inflamed mucous surfaces will not come in contact with each other. Some surgeons prefer lotions or washes. A small piece of cotton is spread out over the surface of the glans penis and moistened with a solution of lead-water and laudanum, or with such a combination as the following:—

℞ Zinci sulph., 3 grains.
 Plumbi acet., 6 grains.
 Morph. sulph., 7 grains.
 Aquæ, 2 fluidounces.

and the prepuce pulled forward over the glans. In the presence of erosion or ulcerations the entire mucous surface should be painted over with a solution of nitrate of silver (gr. xx to fʒj).

When complicated by phimosis, the inflammatory œdema must be counteracted by the frequent use of hot compresses, lead-water and laudanum, and subpræputial injections. As soon as the glans can be exposed, the ordinary local treatment as described above is indicated.

In cases of chronic balanoposthitis, or when there are frequent acute attacks, circumcision is to be recommended.

HERPES PROGENITALIS.—A condition characterized by the sudden appearance of one or more vesicles on the balanopræputial mucous membrane, surrounded with an erythematous area, and attended by an itching, burning pain.

The predisposing causes are catarrhal diathesis, neuroses, gout, rheumatism, and phimosis, and the exciting one is any irritation of the balanopræputial mucous membrane.

Symptoms.—Herpes usually appears suddenly as a cluster of vesicles surrounded by a red areola. These vesicles, at first containing a clear serum, which later becomes cloudy, finally dry up and scab over, leaving a bright-red spot. Occasionally the vesicles rupture, and a true ulcer results, which may become of large size when secondarily infected. Sometimes the lesions are accompanied by a slight burning pain; at other times the pain is intense and neuralgic in character. The pain may precede the development of the vesicles. The disease shows a marked tendency to recur and

may occasion a polyganglionic, painless bubo.

Diagnosis.—Herpes must be distinguished from chancre, chancroid, and mucous patches. The chancre usually appears between the tenth and forty-second day; it is single; painless; begins as an erosion, papule, or tubercle; and is indurated, elevated above the surface of the surrounding tissue, shows little or no secretion, and usually disappears spontaneously. Chancroid appears within five days; it may be single, but is usually multiple from autoinoculability; begins as a pustule, always ulcerates, is punched out, secretes profusely, and is often painful. The mucous patch is always accompanied by other manifestations of syphilis.

Treatment.—The basis of all treatment is cleanliness. The parts should be frequently washed with warm water, and each vesicle touched with nitrate of silver (gr. xx to fʒj), and the application of such powders and lotions as are applicable for balanoposthitis. When the pain is neuralgic, a 4-per-cent. solution of cocaine or a drachm of chloral to the ounce of water may be applied. Constitutional treatment should always be directed to the correction of any existing dyscrasia. In recurrent herpes circumcision is the only means that will bring about a permanent cure.

Tuberculosis of the Penis.—Tuberculosis of the penis is an extremely rare condition. It may be periurethral, balanopræputial, and urethral. The disease, as in other parts of the body, is characterized by the formation of ragged, irregular, undermined ulcers, of very slow growth, and exhibiting little or no tendency to heal. The inguinal glands are often involved, and occasionally undergo caseous changes.

TREATMENT.—When seen early, they

should be curetted, touched with pure carbolic acid, and dressed antiseptically with iodoform. Internally, remedies should be administered to correct the existing diathesis. In later stages amputation of the organ may be necessary.

Tumors of the Penis.—Tumors of the penis may be either benign or malignant, solid or cystic.

The benign tumors include cysts (mucous, sebaceous, or hæmorrhagic), adenoma, fibroma, horns, elephantiasis, papillomata, and vascular growths.

The malignant tumors include sarcoma, carcinoma, and epithelioma. With the exception of sebaceous tumors, cysts are rare; the former may occur in any region where sebaceous glands are present.

Adenoma and fibroma are exceedingly rare. Guitéras and Beck each report a case. They coincide completely with similar growths in other parts.

Horns springing from the glans have been reported by Brinton and others. They have the appearance of a nail, and when dry are smooth and polished.

Elephantiasis usually involves the penis and scrotum, which organs may attain large size. It is but rarely seen in temperate latitudes. It may result from wounds and diseases which obstruct the lymph-channels.

The treatment of this condition is unsatisfactory. Large doses of iodide of potash may be tried. Circumcision may be performed so as to remove as much of the thickened skin as possible.

Vascular growths are occasionally found along the dorsal vein and include angiomas and nævi.

The treatment of benign tumors of the penis is that appropriate for like conditions in other parts of the body: removal when increasing in size or interfering with function.

PAPILLOMATA, VENEREAL WARTS, OR VEGETATIONS, represent an overgrowth of the papillæ of the balanopræputial mucous membrane. They are usually due to repeated attacks of balanoposthitis superinduced by a redundant or phimotic prepuce in young men who are uncleanly. They are in no sense venereal in origin.

Symptoms.—Venereal warts appear as large or confluent, moist or dry, pedunculated or sessile papillary overgrowths, usually springing from the coronary sulcus, the glans penis, or the inner layer of the prepuce. The confluent warts often assume the shape of a cauliflower. They grow rapidly, are exceedingly vascular, and often attain large size.

A diagnosis must be made from syphilitic condylomata and epithelioma. Syphilitic condylomata are usually associated with other evidences of syphilis. Epithelioma appears late in life, grows slowly, and is markedly indurated.

Treatment.—When small and single, these growths may be destroyed by the frequent application of carbolic or chromic acid. When large, the penis should be covered with carbolized olive-oil (to protect it from acids), the warts rapidly cut away with scissors, going well down into healthy tissue and cauterizing the base with pure carbolic acid. A piece of lint or gauze saturated with a 25-per-cent.-boroglyceride solution should be held in place over the raw surfaces by a bandage. When large masses are removed it may be necessary to touch the base with the actual cautery in order to control the hæmorrhage.

MALIGNANT DISEASE.—With the exception of epithelioma, malignant disease of the penis is rare, although malignant tumors are much more commonly observed than the benign varieties.

Epithelioma of the penis may exist in the form of an ulcer or cauliflower-like

growth. A redundant prepuce or phimosis predisposing to balanoposthitis, with consequent maceration, may act as a predisposing cause.

Symptoms.—The disease usually begins as an insignificant ulcer or wart, beginning most frequently at the præputial orifice or coronary sulcus. It grows slowly, and gradually infiltrates the surrounding tissue. The prepuce is finally destroyed, and an offensive, ichorous discharge covers the ulcer, which shows great tendency to bleed on the slightest manipulation. As the disease extends backward, the cavernous bodies become indurated, the skin adherent, and the inguinal lymphatic glands become enlarged and ulcerate.

There is usually no difficulty in making a diagnosis except in the very earliest stages. Under such circumstances a small section might be removed under cocaine and a microscopical examination made.

The prognosis is exceedingly bad unless the growth is removed very early.

Treatment.—Amputation or extirpation of the penis, depending upon the amount of tissue involved, is indicated. The infected lymphatics from both groins should always be removed at the time of operation in order to prevent recurrence.

Analysis of 359 cases. Epithelioma is by far the most frequent form of carcinoma of the penis, and its frequency is about 2 per cent. of all cancers. Phimosis is a strong predisposing factor by causing chronic irritation. As a rule, epithelioma is more frequent after middle life, though, like every other rule, this has its exceptions. The syphilitic virus has absolutely nothing to do with epithelioma, the scar of the old specific lesion being nothing more than an area of decreased resistance or a cause of chronic irritation. Traumatism is a predisposing factor by causing an area of decreased resistance. The ques-

tion of the contagiousness of epithelioma is still to be decided. Epithelioma more commonly begins in the glans or prepuce; an origin in the urethra is very rare. Visceral metastasis is also very rare. The prognosis in the precancerous stage is favorable if radical treatment be at once instituted; later it is only guardedly so. The only safe treatment in any stage consists in the thorough eradication of the area of disease and of all lymphatic glands that are involved. F. D. Patterson (Univ. of Penna. Med. Bull., July, 1901).

Amputation of the Penis.—Amputation of the penis is indicated for the relief of tuberculosis and malignant disease.

The operation may be performed either by the flap or circular method; the former, however, is to be preferred. Hæmorrhage is to be provided against by transfixing the root of the penis with two long pins, and surrounding the organ with an elastic bandage above. These prevent the ligature from prematurely slipping after the organ has been removed. The position and shape of the flaps is to be governed by the limits of the disease. Whenever possible, a long anterior flap is to be preferred.

A narrow-bladed knife is introduced between the cavernous and spongy bodies at a point at least one inch behind the disease, and a small posterior flap is then cut forward and downward. From this flap the urethra is to be dissected free. A flap of sufficient length is cut from the dorsum and sides of the penis, reflected backward, and the cavernous bodies divided on a level with the line of reflection. The dorsal artery is now tied, the tourniquet removed, and any spurting vessels ligated with fine catgut. The stumps of the cavernous bodies are now covered by suturing together their fibrous envelopes (*tunica albuginea*). The anterior flap is punctured, the urethra

drawn through it, slit up, and sutured in place. The two flaps are now united with silk-worm-gut sutures. A Nélaton catheter should be tied in place for a week, and then a meatal bougie passed at regular intervals to prevent contraction of the new urethral orifice.

Extirpation of the Penis.—Extirpation of the penis is indicated when malignant disease has extended as far back as the scrotum.

The patient should be placed in the lithotomy position, and the scrotum split along the entire length of the raphé. After exposing the anterior layer of the triangular ligament, the spongy body is dissected free and cut off, leaving sufficient to bring out through the perineal incision. With an elevator, the crura are dissected from the pubic arch; the incision is prolonged about the penis above, the suspensory ligament divided, and the dorsal arteries secured. The stump of the spongy body containing the urethra is now slit up, stitched in the posterior part of the scrotal incision, and the external wound is closed. A catheter should be introduced into the bladder and retained in place for a week.

Diseases of the Testicles.

Anomalies.—**POLYORCHISM.**—Quite a number of cases have been reported of men who have three, four, or six testicles, but only in very few authentic cases has the anomaly been verified by post-mortem or operation. In some of the supposed cases tumors, hernias, and hydroceles have been found.

ANORCHISM.—Congenital absence of the testicles has been occasionally reported, but on dissection, in many of these cases, abdominal retention of the organs was noted. The condition is not so uncommon as a unilateral deformity (monorchism). The pelvic portion of the vas and the seminal vesicle are usually

present, although the prostate is rudimentary on the corresponding side. In a true case of anorchism the voice does not change, there is no beard, sexual organs are rudimentary, and impotence is the rule. These facts might assist in distinguishing between abdominal retention and absence; as in the former, all the characteristics of the male sex are preserved. It may be sometimes difficult to distinguish absence from atrophy of the organs.

Treatment.—When the testicles are absent it might be possible to favor the proper development of the individual by injections or ingestion of the organic extracts (testicular).

SYNORCHISM.—Fusion of the testicle has been reported by Baillie and Schurig. In each instance two cords were found.

HYPERTROPHY OF THE TESTICLES.—The size of the testicle bears no relation to the size of the individual. Compensatory hypertrophy is believed to occur when one testicle has been removed. As large organs are more vulnerable than the small, they should be supported by a suspensory bandage and the subject cautioned as to the dangers of urethritis.

ATROPHY OF THE TESTICLES.—True atrophy is always observed in cases of undescended testicle. Even in the normal position one or both may remain rudimentary. They often regain their normal size as the result of physiological activity. There is no reason to believe that prolonged chastity causes wasting of the organs.

But little can be done for these cases. Misplacements should be corrected, and massage may be tried.

UNDESCENDED TESTICLE.—The testicle may be arrested in any parts of its course in its descent from the kidney to the scrotum; when retained in the abdomen, it is termed cryptorchidism. It

is sometimes found in the groin and in the perineum. The cause of these abnormalities has been variously attributed to small rings, a short cord, peritoneal adhesions, and loss of power or anomalous attachments of the gubernaculum.

Misplaced testicles, as a rule, are undersized, and there is a degeneration and atrophy of the secreting structure. They are often functionless, and sterility results. In some of the reported cases spermatozoa were found. When misplaced outside of the abdomen, the testicles are exceedingly liable to injury, and inflammations and malignant degeneration are common.

Diagnosis.—When the testicle is retained in the inguinal canal it must be distinguished from hernia, which can usually easily be done by noting the absence of the testicle from the scrotum, ovoid shape, irreducibility, and the sickening pain when pressed upon. When situated in the region of the groin, it may be confused with bubo, especially when orchitis is present. The same rules, however, hold good as in the case of hernia.

Treatment.—When the organ still remains in the abdomen, nothing can be done by surgical intervention; its attachments, being necessarily short, would prevent its being dragged down into the scrotum. When situated in the inguinal canal, an effort should be made to bring it into the scrotum by daily traction, its return into the canal being prevented by the use of a truss having a very soft pad. If it cannot be drawn down into the scrotum by the sixth year, operation is necessary (orchidopexy). The gland is exposed by a free incision, and brought out of the wound, so that the fibres of the cremaster may be divided transversely. The cord is then gently stretched until the testicle hangs free beyond the exter-

nal abdominal ring. The scrotum is now invaginated and fastened to the base of the testicle by three catgut or silk sutures. When the invaginated scrotum is drawn out, the anchored testicle is carried into its proper place. The deeper tissues are closed by catgut, and the tissues of the cord are sutured to the pillars of the external ring.

In the femoral variety of misplacement, the testicle should be returned to the abdominal cavity and held in place by a truss. In the perineal form, the operation for inguinal displacement can occasionally be carried out. When situated near the internal ring, it should be protected from injury by the use of an appropriate pad or truss.

When seen late in life, castration is always advisable, as the organ is probably functionally useless, and is liable to sarcomatous degeneration.

INVERSION OF THE TESTICLE.—The testicle may have descended to the base of the scrotum, and then assumed various faulty positions (anterior, lateral, horizontal, and rotatory), the horizontal being the most common.

LUXATION OF THE TESTICLE.—The testicle may be luxated from its normal position by blows, muscular action, and sudden contraction of the cremaster. It usually becomes rapidly inflamed.

Treatment.—When seen early the luxation should be reduced by manipulation and traction, a pad being applied over the external ring. When adhesions have formed, as in old unreduced cases, the operation for undescended testicle may be required.

TORSION OF THE TESTICLE.—The cord of an undescended testicle may be twisted as the result of congenital malformations. The symptoms depend upon the amount of torsion. There is usually inflammation and possible gangrene. This con-

dition must be distinguished from strangulated hernia and epididymitis. In torsion the epididymis is anterior, while in epididymitis it is posterior. In a hernia there is no impulse on coughing and obstructive symptoms are absent. Simple orchitis is to be distinguished by the normal anatomical arrangements of the parts.

Treatment.—When seen early the torsion is to be reduced by manipulation and lead-water and laudanum applied, with elevation and rest in bed. After adhesions have formed the testicle and cord must be exposed, the twist reduced, and the testicle secured in proper position by a few sutures on one side. Gangrene requires castration.

Injuries of the Testicle.—When normally situated, the testicle is not often injured. Contusion from kicks, blows, and bruises upon the saddle are not uncommon. There is usually an acute sickening pain, often faintness or syncope, followed by rapid swelling. An hæmatocele or inflammation may ensue, followed by hydrocele and fibroid changes in the organ.

Incised, punctured, and gunshot wounds are occasionally met with, and require the same treatment as similar wounds of other parts of the body. Such wounds usually do well, and castration is seldom or never called for.

Orchitis.—An inflammation of the testicle is caused by gonorrhœa, mumps, tuberculosis, syphilis, and traumatism.

Symptoms.—The symptoms of the simple inflammatory variety are as follow: Dull, sickening pain, radiating toward the hips and back; the testicle rapidly swells, but retains its ovoid form. Occasionally an acute hydrocele develops, and as a result there is an increase in swelling and pain. Occasionally suppuration takes place.

Diagnosis.—Orchitis must be distinguished from epididymitis, which can be readily done by noting the position of the tenderness, this being posterior when the epididymis is involved.

Treatment.—The patient should be confined to bed, the scrotum elevated, and applications of lead-water and laudanum made. The bowels must be kept open and the pain controlled by morphine. In the presence of an acute hydrocele, puncture of the tunica vaginalis with a fine tenotome will often instantly relieve the pain. After the acute symptoms have subsided resolution may be hastened by strapping or the application of mercurial and belladonna ointments. Should an abscess form, it should be opened early, and treated on general principles.

TUBERCULAR ORCHITIS.—Tubercular orchitis is usually secondary to a like affection of the epididymis; the organisms, however, may reach the gland through the blood, and a primary focus develop. The disease is often bilateral, and is most commonly met with between the ages of twenty-five and thirty-five.

Symptoms.—The organ becomes hard, knotty, and irregular; there is a feeling of dragging weight and a sense of discomfort referable to the back. Sooner or later inflamed tissues become adherent to the skin, soften, break down, and rupture spontaneously, leaving fistulous openings, which exhibit little or no tendency to heal. There is little or no pain in the early stages of the disease. Not infrequently the disease has been preceded by tuberculosis of the lungs. Tubercular testicle must be distinguished from syphilitic orchitis. The syphilitic is uniform, hard, painless, and seldom or never suppurates.

In not a few cases resolution takes place. The disease may become capsu-

lated and cause no further trouble. In bad cases it may involve the epididymis, vas, prostate, and bladder.

Treatment.—The routine treatment consists in the internal use of iodide of iron and codliver-oil, with good food, fresh air, and sunlight. Locally, the part should be kept at rest, and iodide-of-lead ointment applied. Should the disease progress, injections of chloride of zinc, from 3 to 5 drops of a 1-per-cent. solution, may be made around the periphery of the focus every third or fourth day. A 10-per-cent. emulsion of iodoform and glycerin may be used in the same manner, from 20 to 30 drops being used at each injection. When the disease is circumscribed, it may be curetted and touched with pure carbolic acid. Such a procedure will destroy the function of the organ. Castration is indicated when other measures have failed.

Radical treatment should not be allowed to become obsolete. Castration has an exceedingly low mortality, considered as an operation, and if performed at an early period of the disease there is a good chance of preventing further infection from the bacillus of tuberculosis from taking place. Castration certainly complies with one of the most urgent demands of modern therapeutics, namely, the eradication of the soil breeding the disease, when, of course, the affection has not been present for too long a period, and has not extended to other parts of the body. Conservative surgery applied to the testicle is practically useless when the organ is affected by tuberculosis, and it allows the dangerous consequences to arise which the radical treatment directly tends to avoid. C. G. Cumston (*American Jour. Med. Sci.*, June, 1904).

METASTATIC ORCHITIS.—This is a frequent complication of mumps. One testicle is usually involved, and atrophic changes are exceedingly common. The symptoms and treatment are similar to acute orchitis.

SYPHILITIC ORCHITIS.—This condition usually occurs as a complication of the third stage of syphilis. The testicle is hard, indurated, somewhat irregular, and painless. Both testicles are often involved.

Treatment.—Mixed treatment, biniodide of mercury, $\frac{1}{12}$ grain, with 20 grains of iodide of potassium, should be administered thrice daily. Locally,unctions of mercurial ointment should be used.

Tumors of the Testicles.—Tumors of the testicles are rather uncommon, but cysts, adenomata, fibromata, chondromata, myxomata, carcinomata, sarcomata, and dermoids are occasionally met with. Cancer is by far the most common tumor affecting the testicle.

Fifteen cases of tumors of the testis. Fourteen of the tumors were sarcomata and 1 was a teratoma. The author regards the latter kind of tumor as almost malignant in character. More than 50 per cent. of the author's cases occurred in young adults between twenty and thirty years of age. It is usually stated that sarcoma of the testis is a disease of childhood and old age. The writer is inclined to believe that traumatism plays an important part in the etiology of sarcoma. Coley (*Medical News*, July 25, 1903).

SYMPTOMS.—Carcinoma is usually unilateral, making its appearance about middle life as a uniform swelling, which grows rapidly, becoming nodular and irregular, and quickly breaking down and ulcerating, leaving a protruding fungous mass. As the disease progresses, the inguinal lymphatics become involved and also the lumbar. The general health rapidly fails, the face becomes cachectic, and the body emaciated.

In the last stages cancer might be mistaken for tubercle. However, the age, rapid growth, and ulceration would all point to malignant disease.

TREATMENT.—Early and complete extirpation is alone indicated.

In radical operation for malignant testicular disease the testicle and its coverings, half of the scrotum with the septum scroti, the cord as high as the internal ring, and the inguinal glands and fat should be removed. Stimson (*Med. Rec.*, Oct. 30, '97).

Hydrocele.—This is a collection of fluid in the tunica vaginalis. It may be acute, as the result of extension of inflammation from either the epididymis or testicle; congenital,—the result of anatomical deficiency in the vaginal and funicular processes; or it may be encysted. In many cases, however, the cause is not appreciable, although it is probable that traumatism and strains may favor its development.

In the acute variety of hydrocele, owing to the prominence of the symptoms of the primary condition, the characteristic symptoms are not pronounced. Pain is agonizing and is due to pressure. In the encysted form swelling, of slow formation, beginning at base of the scrotum and which is pyriform in shape, smooth, tense, fluctuating, and elastic on pressure, is noticeable; this does not, however, alter the size of the organ, which is dull on percussion, stands away from the body, and cannot be reduced. In the congenital variety the swelling is also of slow formation, dull on percussion, filling from below; it disappears when the patient assumes the recumbent posture, but returns slowly when he is in the erect posture. Such hydroceles are frequently complicated by hernia.

Hydrocele of the cord so closely resembles inguinal hernia that it is often mistaken for the latter. The text-books give comparatively little attention to the matter. It is due to a serous exudation in an unobliterated portion of the processes vaginalis. It may be encysted or funicular; in the former the

process is obliterated above and below, but is open between the two points, and in this cavity fluid collects; in the latter the funicular process is closed below, and on raising the pelvis the fluid flows into the peritoneal cavity. The collections of fluid in the cord may be circumscribed or involve its entire length. They may communicate with the tunica vaginalis or the abdominal cavity. In three recent cases the communication was with the abdominal cavity. Traumatism plays an important rôle in the production of this condition, and it often develops after a strain, such as heavy lifting. The diagnosis is not difficult, as the tumor is usually soft, elastic, and translucent. Fluctuation is evident and can be detected well up into the inguinal canal. Unless a hernia exists as a complication the external ring is of normal size, and there is slight or no impulse of the intestine upon coughing. A. Jacoby (*Medical Record*, June 18, 1904).

Diagnosis.—Hydrocele must be distinguished from hernia, varicocele, and hæmatocele. This can usually be done by the "light test." The patient should be examined in a dark room; a candle or lamp is held close to the scrotum, by looking through the scrotum toward the light the swelling will appear translucent. This test may fail in thick-walled sacs.

Differences between essential and symptomatic hydrocele. In the former, the finding of spermatozooids is frequent, while in the latter (originating from growths or inflammatory processes), the spermatozooids are never found. Their presence or absence is thus a very important diagnostic element, and serves in a measure to clear up the mechanism of essential hydrocele. As to the question of a hydrocele becoming tuberculous, or of the tubercle bacilli or their toxins setting up a tuberculous hydrocele, the author's experiments have been entirely negative. They inoculated the fluid from 14 cases into animals and obtained not a single positive result. They do not believe in

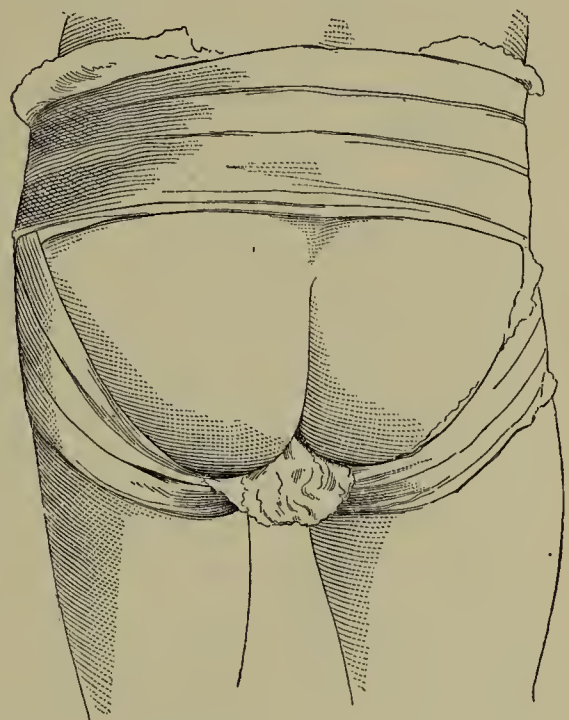
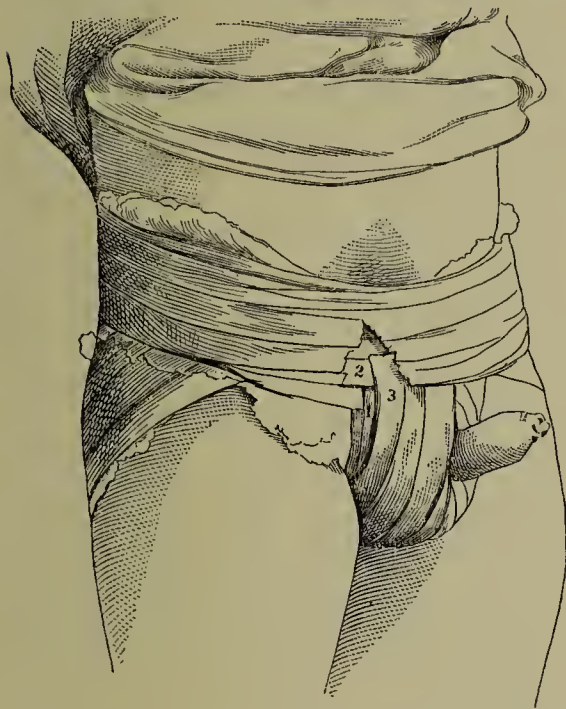
the tuberculous origin of hydrocele except in rare instances. F. Barjon and A. Cade (*Lyon Médical*, July 5, 1903).

Treatment.—In the acute form rest in bed, elevation of the scrotum, and application of lead-water and laudanum are indicated. When the pain becomes very severe, the sac may be punctured. After the acute symptoms have subsided, a well-fitting suspensory should be worn.

In the encysted variety treatment may be either palliative or radical. The palliative consists in tapping with trocar

and injection method, pure tincture of iodine is thrown into the sac after the withdrawal of the fluid. From a drachm to an ounce may be used, according to the capacity of the sac. This method is especially valuable in thin-walled hydroceles.

Treatment of simple hydrocele by puncture and injection of a solution of corrosive sublimate of strength of 1 to 1000 recommended. In a couple of weeks fluid entirely disappears. A puncture is made and corrosive-sublimate solution is injected twice, and lastly a solution of



Compression bandage for scrotum. (Wickham.)

(*La France Médicale*.)

and cannula, drawing off the fluid, repeating the operation as often as the sac refills. In tapping a hydrocele the swelling is made tense, and the trocar is plunged in with a firm, quick, boring motion, being careful not to wound the testicle. A spot should always be selected on the scrotum free from veins, so as to avoid the possibility of hæmorrhage into the loose cellular tissue.

The radical treatment may be carried out either by injections of irritating fluids or cutting operations. In the in-

jection method, pure tincture of iodine is thrown into the sac after the withdrawal of the fluid. From a drachm to an ounce may be used, according to the capacity of the sac. This method is especially valuable in thin-walled hydroceles.

Treatment of simple hydrocele by puncture and injection of a solution of corrosive sublimate of strength of 1 to 1000 recommended. In a couple of weeks fluid entirely disappears. A puncture is made and corrosive-sublimate solution is injected twice, and lastly a solution of boric acid is injected. Etienne (*Gaz. des Hôp.*, Jan. 8, '98).

In the treatment of hydrocele in infants a lotion of ammonium muriate, 10 grains (0.65 gramme) to 1 ounce (30 grammes) of water, should be applied constantly to the scrotum on lint, and under its use the fluid may disappear in a week or two. If, however, it does not disappear, then the distended tunica vaginalis should be tapped with the trocar and cannula and the fluid removed, the tapping being repeated if it becomes filled up again. This usually brings about a cure of the disease; but, if this should fail after tapping, a few

drops of tincture of iodine, carbolic acid, or alcohol may be injected. Radical operations, such as dissecting out a portion of the sac, are rarely required in the treatment of hydrocele in infants or children. H. R. Wharton (*Amer. Jour. Med. Sciences*, Jan., 1902).

Several cases of radical cure by the injection of 2 minims (0.13 cubic centimetre) of carbolic acid. The failure of many to secure a radical cure with iodine is due to the fact that too dilute solutions were employed. The so-called 95-per-cent. carbolic acid, as found in the shops, is usually much below this strength, and is much too weak to give efficient results in the injection method in hydrocele. An important procedure in the technique of the operation is to completely empty the sac. For this purpose a double cannula is employed, the inner one projecting slightly beyond the outer, which may be attached to an ordinary hypodermic syringe when the injection is to be made. The cannula is first introduced and the hydrocele fluid withdrawn, compressing and manipulating the sac so as to empty it completely. The hypodermic syringe is then screwed on to the cannula and from 2 to 3 drops of pure acid injected. W. B. Coley and P. A. Satterwhite (*New York Med. Jour.*, March 29, 1902).

The cutting operations include the open method and removal of the parietal layer of the sac. In the former the tissues of the scrotum and sac are incised, the sac sutured to the skin to prevent adhesions, and the cavity of the tunica vaginalis packed with iodoform gauze to promote healing from the bottom. In the latter the parietal layer of the sac is removed through an incision of sufficient length, and the wound closed. These methods are preferable when the iodine method has failed or when the wall of the sac is thick.

Nineteen hydroceles perfectly cured by slitting up the scrotum and tunica vaginalis by an incision an inch long, stitching the tunica vaginalis to the scrotum, and applying an antiseptic dressing

Cavity was not injected nor interfered with in any way. Lieutenant-Colonel Hall (*Brit. Med. Jour.*, Apr. 8, '93).

The principle of inversion, or eversion of the tunica vaginalis, differs absolutely from that of total excision: instead of removing the serosa, it is retained and turned inside out, thus destroying the secreting serous sac. The secreting surface becomes external, and the secretion is absorbed as it forms. The operation of inversion of the tunica vaginalis is performed as follows: Under local or general anæsthesia an incision is made down to the fibro-serous layer. The length of the incision varies necessarily with the dimensions and position of the hydrocele. The tumor, still unopened, is then dissected by means of gauze or the finger until the mass is free from the cellular layer, especially posteriorly. All bleeding must be checked at this stage by hæmostats or ligatures. A long incision is then made in the sac, from which the liquid escapes. The tunica is then turned inside out, placing the endothelial surface outward, and securing the cut edges of the serosa as high as possible around the cord by means of two or three catgut sutures. The testicle is then replaced in its normal position. It is covered by the skin, dartos, and cellular tissue. Suture of the skin without drainage completes the operation, which requires generally from five to ten minutes.

A very mild local reaction, and, exceptionally, some tenderness over the testicle, may be noted during the first two or three days. Dudley Tait (*Annals of Surg.*, Mar., 1901).

Review of three hundred and thirty-eight operations. The injection method proved the most unsatisfactory. That devised by Doyen (1895), and recommended by Winkelmann (1898), proved the best. It is performed under local anæsthesia as follows:—

The ordinary incision is made through the scrotal tissue down to the tunica vaginalis. An opening is then made in the upper portion of the sac in the vicinity of the cord, through which the testicle is drawn after the fluid is evacuated; then the tunica vaginalis propria

is everted. To prevent the testicle from slipping back into the sac, the upper part of the tunica vaginalis is secured by means of fine catgut sutures to the fascia of the cord, a suture being placed at the same time at the lower end of the tunic, anchoring it in its new position and preventing the return of the testicle to its former position. The testicle, together with the inverted sac, is then replaced within the scrotum and the wound closed by interrupted sutures. The time needed for the operation is less than ten minutes. It is not attended by hæmorrhage, and no ligatures are needed. The operation was first performed in this country by W. W. Keen. In large hydroceles of long standing, with thickened sacs, the operation is not practicable. In these resection must be employed, as it is impossible to invert the tunic. In all cases operated upon by eversion a painless enlargement of the testicle resulted, not attended by rise of temperature, the enlargement subsiding at the end of ten days. Orville Horwitz (Therap. Gaz., Apr. 15, 1901).

Series of nineteen cases of hydrocele treated by Winkelmann's operation. Local anæsthesia was employed in all but one case, in which a hernia was also operated by Bassini's method. The results were excellent in every case. Ohl (Deutsche Archiv f. Chir., May, 1901).

Congenital cases can occasionally be cured by the application of a truss. If this fails, an antiseptic seton will usually prove successful.

Spermatocele.—A collection of milky fluid in the tunica vaginalis containing spermatozoa gives rise to symptoms similar to hydrocele. The treatment is the same as that for the latter disorder.

Hæmatocele.—This is a collection of blood in the tunica vaginalis, which may either be due to traumatism, disease, or occur as a sequel to the tapping operation for hydrocele.

The scrotum assumes a globular shape, the largest circumference being below. The tumor does not fluctuate and does

not transmit light. Being abnormally heavy, it is unusually low.

TREATMENT.—Rest in bed, elevation of the scrotum, and the application of lead-water and laudanum are first indicated. After the acute symptoms have subsided, the scrotum should be strapped. When these measures fail, the tunica vaginalis should be opened, all clots turned out, and an iodoform-gauze packing introduced.

Epididymitis.—Inflammation of the epididymis may be inflammatory, syphilitic, and tubercular. It commonly results from the extension of gonorrhœal inflammations from the posterior urethra through the sac, but is sometimes due to syphilis and tuberculosis.

SYMPTOMS.—These are of the inflammatory type: tenderness along the cord, hard swollen vas, and pain in the back. The testicle rapidly swells, and becomes exceedingly tender, the patient walking with a stooping posture and the legs wide apart. On examination the tenderness and swelling will be found confined to the posterior part of the scrotum. An acute hydrocele by contiguity may result. Suppuration is rare, the general tendency being always toward resolution. Traces of the attack often remain for a long time after the inflammation has subsided, the regular outline of the organ being interrupted by masses of lymph.

The *syphilitic* variety is usually noted as a complication of the secondary period, and consists of small, gummatous lesions.

The *tubercular* variety may be primary, but is often secondary to that of the testicle or prostate. The disease usually begins in the head of the organ as a series of nodules, of slow growth, which become adherent to the skin, soften, and leave a fistulous opening. This form is usually followed by sterility on the affected side.

TREATMENT.—In the simple inflammatory form rest in bed, elevation of scrotum, and lead-water and laudanum are indicated. When the pain is severe, the acute hydrocele may be punctured. After the acute symptoms have subsided, the testicle should be strapped and small doses of iodide of potassium should be given internally to favor resolution.

Salicylate of soda used in the treatment of gonorrhœal rheumatism with success. After a thorough purge with sulphate of magnesia, rest in bed with elevated testicles being enforced, the salicylate is given in four doses of 15 grains each, and repeated each day as long as required. In ordinary cases the swelling and pain rapidly disappear. Picot (*Gaz. Heb. de Méd. et de Chir.*, Apr. 16, '99).

In blennorrhagic epididymitis the scrotum should be cleansed with soap, and the following ointment applied with a layer of cotton supported by a suspensory bandage:—

R̄ Guaiacol, 45 grains.

Vaselin, 450 grains.

Janowski (*Indépendance Méd.*, May 3, '99).

A 10-per-cent. solution of guaiacol in vaselin recommended. This is smeared on the scrotum once a day, and covered with wool and a suspensory bandage. Internally, salol, 7½ grains (0.5 gramme), or salicylate of soda, 15 grains (1 gramme), are given four times a day. The pain is eased at once, and the resolvent effect is rapid, cure taking only about twelve days. Bocchi (*Gaz. degli Osped.*, March 16, 1902).

The syphilitic form requires the mixed treatment internally, combined withunctions of mercurial ointment. The tuberculous type is met by the measures indicated in tuberculosis of the testicle.

Castration.—The operation for the removal of the testicle is indicated when tumors, tuberculosis, gummata (occasionally), or extensive suppuration are present, or for the relief of enlarged prostate and certain cases of undescended testicle.

OPERATION.—The testicle being made prominent, an incision is made from the base of the scrotum to the external ring. When the skin is involved, two elliptical incisions should be made. The testicle, with its tunics, is now quickly freed and the cord exposed. While traction is being made, a double catgut ligature is passed through the cord with an aneurism-needle, the loop cut, and the needle withdrawn. The cord is then ligated in each half and once around, and divided one-fourth of an inch below the ligature. The stump is cauterized with pure carbolic acid to prevent infection of the wound from the vas. All hæmorrhage being controlled, the wound is closed by silk-worm-gut sutures, the operator being careful to evert the skin-edges.

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PENTAL.—Pental (trimethyl-ethylene or beta-iso-amylene) is a colorless, inflammable liquid, insoluble in water, but miscible in all proportions with alcohol, ether, and chloroform. It does not decompose on exposure to light and air. It was discovered and described by Balard in 1844 and used in 1856, after which it dropped out of sight. Toward the end of 1891 it was resurrected by von Merling, and its use advised as an anæsthetic for dental and minor surgical operations, in doses of 2 to 3 drachms by inhalation, or applied as a spray for local anæsthesia.

Physiological Action of and Poisoning by Pental.—Pental is, according to the experiments of Wood and Cerna, a dangerous cardiac depressant, and therefore a most dangerous anæsthetic. Untoward symptoms—such as excitability, tremors, difficulty of speech, headache, erythematous eruptions, and even convulsive movements—have been reported as se-

quelæ of pental anæsthesia. Albumin, casts, and blood have been found in the urine after its use. Temporary cessation of respiration with cyanosis is not infrequent during its administration, and Cheyne-Stokes respiration has been observed. The circulation has been much embarrassed through its depressing action upon the heart, and death has ensued from respiratory and cardiac paralysis.

Treatment of Poisoning by Pental.—The treatment of poisoning by pental is similar to that of chloroform poisoning. If the drug has been swallowed, the use of an emetic or stomach-siphon to evacuate the stomach and subsequent stimulation are indicated. If pental has been inhaled, with the first dangerous symptoms it should be instantly discontinued and fresh air admitted. Water may be dashed on the face, the tongue pulled out, artificial respiration practiced, the galvanic current applied, and an hypodermic injection of $\frac{1}{30}$ grain of strychnine given, as quickly as possible. Death by this agent is often so rapid that treatment is of no avail.

Therapeutics.—The principal use of pental is that of producing general anæsthesia, especially for short operations. It is only mentioned in this work to emphasize its dangers and to emphatically condemn its use as an anæsthetic. Prince Stallard has shown that the fatality of this agent has been 1 out of every 164 administrations. T. J. Walker has rightly protested against its further employment, this proportion of deaths being one hundred times greater than that of any other anæsthetic.

PENTANE.—Pentane, or amyl-hydride, is a fluid preparation obtained from coal-tar or petroleum. It occurs as a colorless, inflammable liquid, having

a pleasant, fruity odor, and is soluble in alcohol.

Pentane is an hydrocarbon (C_5H_{12}), the fifth in number of the paraffin series.

It was proposed as an anæsthetic and is said to act without causing irritation or dyspnœa, but it has not been sufficiently used to insure its recommendation.

PEPSIN.—Pepsin (pepsinum, U. S. P.) is a proteolytic ferment obtained from the glandular layer of fresh stomachs from healthy pigs, and capable of digesting not less than 3000 times its own weight of freshly coagulated and disintegrated egg-albumin, when combined with 1000 times its weight of a 2-per-cent. solution of hydrochloric acid and maintained for six hours at a temperature of not less than 100.4° F. or more than 104° F., the vessel in which it is contained being gently agitated every fifteen minutes. At the end of the given time little or no residue should be observed, but a few thin flakes of the coagulated albumin need hardly be regarded. Pepsin occurs in yellowish-white or white scales or in powder, having a slight acid or saline taste and should be free from odor. Much of the commercial pepsin is adulterated or contaminated with peptone, and may also contain mucus and albumin. The presence of peptone is manifested by its peculiar musty odor, and, if it be present in large amount, it will absorb moisture and become sticky when exposed to the air.

Preparations and Doses.—Pepsinum, U. S. P. (pepsin, 1-3000), 1 to 10 grains.

Pepsinum saccharatum, U. S. P. (saccharated pepsin, 1-300), 5 to 30 grains.

Besides the officinal preparations, there are others on the market which may be preferred. Essence of pepsin (1 to 4 drachms), glycerole of pepsin ($\frac{1}{4}$ to 1 drachm), the liquor pepsini, U. S. P.,

1880 (1 to 4 drachms), pepsin cordial (1 to 2 drachms), and wine of pepsin (1 to 4 drachms) are available fluid preparations.

Physiological Action and Therapeutics.—The terms “peptonized” and “peptone” are so fixed in the popular mind in association with pepsin that many continue to regard a peptonized food as one made with or containing pepsin. Pepsin is not available for peptonizing food for the sick in the household. Its action is not only restricted to albuminous (proteid) substances, but, acid being indispensable, the product is, for this reason, unsuitable as a food. In the laboratory it may be used and is used, for there the acids are removed and the products are properly clarified. Pepsin is useless in the artificial digestion of milk. Pepsin cannot be used for the artificial digestion of food at the table in the way that pancreatic extract may be.

Pepsin, even in large quantities, has no inhibitory action on lactic-acid fermentation, and whatever inhibition is exerted by native or artificial gastric juice depends on the hydrochloric acid. Combined hydrochloric acid in large quantities also exerts such an action. Even on other forms of fermentation pepsin has no hindering influence of any importance; at least, none that can be compared with the antibacterial action of hydrochloric acid. L. Aldor (Berliner klin. Woch., July 25, '98).

In using pepsin, or other digestive ferment, certain points should be observed, lest the ferment become inert before ingestion. A digestive ferment should never be mixed with water or any fluid of a higher temperature than can readily be borne by the mouth. In the peptonizing process, in sprays, in surgical solvents, too high temperature should be avoided. Pepsin is destroyed in alkaline solutions (with lime-water, sodium bicar-

bonate, aromatic spirit of ammonia, etc.). All ferments in solution soon decompose unless in the presence of an antiseptic. The ferments should not be mixed undiluted with strong, alcoholic tinctures or astringents. Pancreatic ferments should not be placed in acid mixtures. Pepsin and pancreatic ferments should not be mixed together in solutions, acid or alkaline. These mixed ferments cannot be permanently held in an active form in any solution. (Fairchild.)

Pepsin is best given with or immediately after food (as its digestive action is solely expended upon the proteids, which action takes place at once in the stomach), combined with hydrochloric acid (as the presence of the acid converts any pepsinogen in the gastric tubules into pepsin), as an aid to weak digestion. Pepsin is useful in atonic dyspepsia, especially in that present during convalescence from acute diseases. Gastric irritability is relieved by pepsin combined with bismuth in powder (bismuth in solution is incompatible with pepsin).

Pepsin is of value in gastralgia, pyrosis, gastric catarrh, and infantile aepsia. In gastric ulcer and in carcinoma of the stomach pepsin relieves the vomiting and assists the impaired digestive organs.

Pepsin is an efficient digestive ferment only in proteid indigestion. It is useless in intestinal indigestion, as it has no solvent action upon fats or starches. As a remedy for indigestion, pepsin is much inferior to pancreatin (pancreatic extract) or papain.

In INFANTILE DIARRHŒA arising from indigestion pepsin is a useful adjunct to other treatment; essence of pepsin given in doses of 10 to 30 drops immediately after nursing will assist in the digestion of the milk-curds. In this disorder peptonized milk will give better results than pepsin.

In TYPHOID FEVER 5 grains of pepsin combined with 10 drops of dilute hydrochloric acid, given in a wineglassful of water, after nourishment, three times daily, will be found useful in assisting the impaired digestive powers and in controlling the febrile movement.

SURGICAL SOLVENT.—Pepsin will dissolve blood-clots in the urinary bladder, and render their expulsion easy. Pepsin has been used in diphtheria and membranous croup to dissolve the false membrane. For this purpose it may be applied in powder by insufflation, or in solution by spray or applicator (brush or probang).

Pepsin has been used as a local application to cancers and sloughing ulcers, with the view of removing sloughs and dead bone; and to abscess-cavities and sloughing wounds to remove the dead tissue and bring about a clean, healthy condition. Glycerole of pepsin is best fitted for this use, although the dry powder or scales have been successfully employed for this purpose.

Case of a machinist who received burn of the third degree. This was at first treated with carron-oil and next day with iodoform gauze. At the end of three or four days the wound was covered with a dirty-whitish purulent secretion with raised edge. Some places were curetted. Pepsin was then sprinkled over the arm and the whole surrounded by a gauze bandage. At end of four days this was removed and wound-surface was studded over with healthy granulations, and here and there new patches of epidermis had commenced in this short time to develop. Wound was then again cleaned with antiseptics and another sprinkling of pepsin applied. At the end of about twelve or thirteen days the whole arm was healed and there was no scar-tissue. Patient was anæmic and suffering from *tabes dorsalis*. O. Waterman (*Ther. Monats.* xiii, p. 30).

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PERICARDIUM, DISEASES OF THE. Pericarditis.

Definition.—Inflammation of the serous covering of the heart, the result of primary or secondary infection.

Symptoms.—The subjective symptoms may vary greatly in severity. In mild cases the disease may call no attention to itself, and its discovery can only be made, if at all, by means of careful physical examination.

In severer cases there is uneasiness or pain in the cardiac region, with moderate fever and a general feeling of bodily distress. An important symptom is shortness of breath. There may also be palpitation, tenderness of the præcordial region, and a dry cough. As fluid accumulates in the præcordial sac, the symptoms change correspondingly, the heart's action being more embarrassed (especially its diastole), the dyspnœa and sense of anxiety increasing, yet pain, on the other hand, diminishing. In young children pain is usually absent. It has been stated that the pain is greater in pericarditis with effusion than in merely fibrinous pericarditis. This statement applied, so far as regards cases with effusion, to the time before the effusion develops.

The pulse at first is apt to be rather forcible; in later stages it becomes irregular, intermittent, and of low tension. The disturbance of cerebral circulation is shown by wakefulness, headache, and in severer cases dullness, delirium, or even melancholia. Rare complications are chorea and epilepsy.

Great distension of the pericardial sac may occasion dysphagia, which may be lessened if the patient is raised into a sitting posture or bends forward. Sometimes the difficulty in swallowing appears to be due merely to nervous disturbance. There may likewise be vomiting, of nervous origin, because of irritation of the

recurrent laryngeal nerve. Balfour warns us that the occurrence of delirium in the course of rheumatic fever ought at once to direct attention to the heart.

As regards objective symptoms, the disease may, as already said, run its course without directing the patient's attention to its existence; likewise the disease may escape the persistent and assiduous efforts of the physician to discover it. In general appearance the patient is apt to be anxious, distressed, and of a dusky countenance.

Before any effusion has accumulated in the heart-sac there may be tenderness on friction over the cardiac area; there is not apt to be great enlargement of the heart, although it may become somewhat dilated. In the early stages of the disease the heart's impulse is somewhat exaggerated, but later it becomes feeble. The veins of the neck may be distended or may even display pulsation. If there is considerable effusion, the præcordia may be somewhat prominent, especially in children, and the intercostal spaces raised so as to be on a level with the general surface. Sometimes the affected region exhibits œdema, particularly when there is pus.

On palpation it may be possible to detect friction. The apex-beat may be felt in its normal condition. As an effusion collects, the apex becomes less easily palpable, and finally disappears. Sometimes, however, it will be discovered if the patient can bend forward, thus causing the heart to approach again more closely to the chest-wall.

Gibson states that "the vocal fremitus over the sternal region loses some of its intensity, and even fluctuation has been observed." As fluid collects in the sac, the area of cardiac dullness increases in every direction. The classical description of the shape of the dull area is that

it resembles a triangle, or a pear hanging by its stem, with its base at the lower part of the chest. These shapes are more often exhibited by large than by moderate effusions. The extension of the dullness upward and to the right is quite constant. It is possible that adhesions may modify the position of the fluid. Sears, for example, mentions a case in which the heart lay against the anterior chest-wall, and about half a pint of pus had collected behind the organ.

There are three characteristic points about the enlarged area of dullness: (a) The apex-beat, as determined either by palpation or auscultation, is found to lie an inch or two within the left border of dullness. (b) The cardiac impulse is feeble and difficult of appreciation, which would not be the case if the extensive dullness were due either to hypertrophy or dilatation of the heart itself. (c) The normal heart-sounds are feeble and distant, while *perhaps* the radial pulse is comparatively strong.

A large collection of fluid may affect the pulse in a peculiar way, which, although not pathognomonic, is of considerable value. The "paradoxical" pulse, as it is called, varies with the cycle of respiration, becoming weaker or imperceptible during inspiration.

The distinctive auscultatory sign of pericarditis is the friction-sound. This may be heard over any part of the heart, more frequently, however, at the base than at the apex. It is near the ear, increased by gentle pressure with the stethoscope, and is described in various cases as rubbing, grating, or creaking; it is apt to be somewhat harsh and it may be interrupted, or "jerking." It may be systolic or diastolic in time, more often it is a double murmur, and it may be triple. In any case it is not apt to be exactly synchronous with the systole and

diastole of the heart. In this respect, as well as in its nearness to the ear, it differs from the endocarditic murmurs, and it also differs in the limited area over which it may be heard.

The pericarditic friction is not transmitted so far as are valvular murmurs. Friction may not be heard when the patient is lying horizontally, and become audible when he sits or bends forward. Sometimes it is heard inside the angle of the left scapula. The intensity of the friction is influenced by respiration, being usually louder during inspiration.

The heart-sounds proper are feeble and distant, or they may be drowned by the friction-murmur. Cases which present both endocardial and pericardial murmurs are naturally perplexing.

Certain accessory signs in the lung remain to be mentioned. In the case of large effusions the percussion-sound in the left axilla at about the level of the nipples is a muffled tympany; posteriorly below the angle of the left scapula the compressed lung may give a slight dullness on percussion and bronchial breathing.

The rapidity of the process varies greatly. Sometimes a dry pericarditis lasts but few days; a rheumatic pericarditis may cause a rapid effusion of sero-fibrin, so that in forty-eight hours the sac will be much distended; and in other instances there is a gradual increase of fluid for several weeks.

In septic cases pus develops rapidly, and death may ensue in three or four days. Rheumatic cases usually pursue a favorable course, and seldom demand active interference. On the other hand, when the pericarditis complicates pleurisy, pneumonia, valvular disease of the heart, or chronic nephritis, life is in great danger. Tubercular pericarditis is al-

most absolutely hopeless, although it may pursue a chronic course.

Diagnosis. — From what has already been said it follows that in some instances pericarditis cannot be diagnosticated, subjective and objective symptoms both failing. Other cases are self-evident. In a third class of cases we have the possibility of confusion with endocarditis; hypertrophy, or dilatation of the heart; myocarditis; and localized pleurisy.

The endocarditic murmurs are apt to be localized at places corresponding with the valves of the heart, and to be transmitted farther than friction-sounds. They are, moreover, synchronous with the heart's movements, and they usually have a softer, blowing, and distant character, which contrasts with the harsher sound, near the ear, of pericarditis.

The hypertrophied heart is usually easily distinguished from pericarditis; the impulse is vigorous, the heart-sounds loud, and the outline of dullness is, although greater than in health, yet approximately normal in shape.

Certain cases of dilatation of the heart are perplexing, especially where the pericardial friction-sound has been heard within a short time previous. The observer is obliged to consider carefully whether the enlargement of the cardiac area of dullness and the feebleness of the heart-sounds are due to change in the heart-wall or to an effusion outside of it.

In dilatation the heart-sounds are clear, and the first sound of the heart may be, although valvular, quite strikingly distinct. The apex of the heart is never displaced upward by mere dilatation.

The cardiac impulse is often extensive in cases of dilatation, although giving the impression of feebleness and irritability, and the area of dullness is rather more quadrilateral than pyramidal, although,

it must be confessed, too much stress cannot be laid on this distinction.

Experiments on the cadaver tend to show that a pericardial effusion cannot be diagnosed by percussion except it be more than 150 to 200 cubic centimetres. The maximum amount of fluid that can be accommodated in the pericardium varies from 650 to 700 cubic centimetres. In the horizontal position with pericardial effusions the cardiac area is increased in all directions more or less, according to the quantity of fluid. On the other hand, in the upright posture the increase is mainly at the lateral limits and particularly in the cardio-hepatic angle. In the former case the anterior surface of the heart is not always covered by fluid, while in the latter, as a rule, it is. In the horizontal position fluid accumulates about the large vessels, even when the effusion is slight; in the vertical position the vessels are free, even in the presence of large effusions. Aporti and Figaroli (*Gaz. degli Osped.*, May 20, 1900).

The development of pericarditis is overlooked unless particularly sought for. Pericarditis of a severe type may develop during the course of a very mild pneumonia. The difficulty of distinguishing obliterative pericarditis from acute general tuberculosis involving the serous membranes is shown by 3 cases. The author concludes by summarizing the important signs of adherent chronic pericarditis thus: 1. A systolic retraction in the region of the apex. 2. The sign described by Broadbent, which is a distinct systolic retraction of the chest wall in the region of the eleventh and twelfth ribs on the left side. 3. Friedrich's sign, a collapse of the cervical veins during diastole, and, according to Kussmaul, a swelling of the cervical veins during inspiration. 4. The pulsus paradoxus is significant of adherent pericarditis or rather of the dilatation which follows. The pulse becomes small and feeble during inspiration due to traction on the adhesions during the inspiratory expansion of the lungs. As these bands are drawn upon it causes a constriction of the vessels of the mediastinum, thus resulting in a small

feeble pulse wave during inspiration. Paul (*Medical News*, Mar. 26, 1904).

A rough systolic murmur simulating that of pericarditis may be heard at the base in case of chlorosis, but usually the two diseases can be distinguished without difficulty.

Considerable stress in point of diagnosis has been laid upon the fact that pericardial murmurs become more distinct when the patient sits up in bed, but it should be borne in mind that similar changes are not infrequently demonstrable in the case of endocardial murmurs.

In pneumonia, and in pleurisy accompanied by pericarditis, the diagnosis of the latter is sometimes impossible. Of 57 cases of pneumonia under personal care during the past three years, 20 have come to autopsy. In 13 of these pericarditis was found; in 5 the pericarditis was detected during life; in the other 8 it was carefully sought for, and the absence of its signs was recorded.

Hydropericardium, with or without inflammation of the sac, in nephritis and cardiac insufficiency, may be masked by hydrothorax, ascites, passive congestion of the liver, and other results of hydræmia and stasis.

In pericarditis pain in the cardiac region is very frequently absent, often it is slight; it is most marked in the relatively vigorous persons suffering from a mild primary disease. The less severe the original disease, the more likely are symptoms suggestive of secondary pericarditis to be present.

The diagnosis must rest mainly on physical signs, but these may be entirely absent. Friction is often evanescent, and may come and go between examinations which are separated by too long an interval. Another source of fallacy is the pleuro-pericardial friction. If there is no other evidence of disease in the lungs with which pleurisy is apt to be associated, and no other evidence of pleurisy than friction within the pericardial limits, the chances are in favor of the pericardial origin of the friction, especially in the rheumatic cases.

Conversely, with other evidences of pleurisy, or of a cause for it, a friction in the above area is probably pleural. Change of the percussion-sound upward or laterally, with change in the position of the patient, is a valuable sign. Pulsus paradoxicus observed in 5 out of 8 cases. F. Shattuck (Boston Med. and Surg. Jour., July 8, '97).

Diagnosis is difficult in those cases in which a friction-murmur has never been detected. If, however, the patient's condition becomes threatening, and the possibility of a considerable effusion exists, it is a proper and comparatively safe measure to insert an hypodermic needle, with aseptic precautions, so as to see whether fluid can be obtained. Perhaps the best point to choose for this purpose is the fifth left intercostal space, an inch and a half from the edge of the sternum. Shattuck, and also Strümpell, recommend the lower left part of the pericardial sac, a little way inward from the margin of dullness. Another place is the left costo-xiphoid angle: a spot which is probably perfectly safe when there is a large effusion, but otherwise renders one liable to perforation of the liver and diaphragm. If a sharp-pointed needle is employed suction may be begun as soon as the point of the needle is engaged in the tissues, and the needle then pushed cautiously forward until fluid begins to run.

A disadvantage of the needle is that its point may scratch the surface of the heart as it moves with systole and diastole. The trocar and cannula is not open to this objection, and is, on the whole, preferable. Moreover, a cannula can be moved about in order to loosen any adhesions. If there is strong reason to feel that fluid has collected, more than one effort to find it should be made.

While it is important to avoid puncture of the heart itself, this has occurred repeatedly without special damage, and in

only one recorded case has such an accident proved fatal. Sloan saved a moribund patient suffering from pericarditis by unexpectedly drawing ten ounces of blood from the right ventricle.

Etiology.—Pericarditis is never an idiopathic affection. It may be due to infectious germs, or to toxic conditions of the blood, or to inflammation extending from contiguous organs. It is very frequently associated with acute articular rheumatism, and it may precede the joint symptoms, especially in children. It may also complicate scarlet fever, measles, small-pox, and typhoid fever.

Statistics of 100 cases of pericarditis. Of these, 50 were dry, 41 serous, 4 hæmorrhagic, and 5 purulent. Seventy-four were males and twenty-six females. The majority of cases occurred in January. Acute rheumatism was cause in 51 cases; pneumonia in 18; chronic nephritis in 7; pleurisy in 5; chronic rheumatism in 2; gonorrhœa in 2; and various causes in the others, 9 cases being classed as idiopathic. G. G. Sears (Boston Med. and Surg. Jour., Apr. 22, '97).

Among 45,000 cases of diseases in children 66 instances of pericarditis—20 during the first year of life—observed. In 24 cases the cause of the disease was rheumatic polyarthrititis, with or without chorea. Next in frequency were tuberculosis and pleuro-pneumonia. The forms of pericarditis in childhood correspond anatomically to those seen in the adult, though there is a marked tendency in early life to the formation of purulent exudates and to circumscribed or extensive adhesion of the pericardial layers. Serous pericarditis was seen 13 times. In young children the pericardial sac had the shape of a cone with convex walls; as the child grows older, the sac assumes more and more the form of an ovoid pointed toward the apex of the heart. In pericarditis of young children an area of dullness was generally found in the posterior wall of the thorax. This dullness might lead to the diagnosis of pleural effusion, but the fact that respiratory sounds become distinct during deep exploratory puncture serve to de-

cide. Friction-sounds are usually audible, but are finer than in the pericarditis of adults. A. Baginsky (Berl. klin. Woch., Nov. 28, '98).

It sometimes occurs in diphtheria, and not so very seldom in association with pneumonia. Septic processes may give rise to it, such as acute osteomyelitis, puerperal fever, and gonorrhœal infection. It has been known to occur after tonsillitis. Tuberculosis is a very important cause.

Baginsky has shown that in 9 per cent. (six cases out of sixty-six) of a series of cases of pericarditis in children the disease was tuberculous. It is, however, in only a small proportion of these cases of tuberculous pericarditis that the pericarditis gives rise to any important symptoms, and in most instances the tuberculous disease is only discovered at the necropsy.

Tuberculosis of the pericardium may present itself under three different conditions: (1) as a part of acute general tuberculosis miliary tubercles may be present in the pericardium [these do not, as a rule, produce symptoms during life]; (2) as the result of a local extension from a tuberculous focus in the adjoining structures, the lungs, mediastinal glands, etc.; and (3) as a form of pericarditis which is probably secondary to a tuberculous deposit in some part of the body, but where the pericarditis is the prominent feature of the illness and the tuberculous disease elsewhere remains latent, often unsuspected. By some a very large amount of exudation is regarded as a characteristic sign of tuberculous pericarditis. C. A. Sutherland (Lancet, Apr. 8, '99).

Tuberculous pericarditis is not a rare affection. The diagnosis is usually not made except in cases with simultaneously active tuberculous processes in other parts. The occurrence of pleurisy with blood-stained effusion may be regarded as suggestive. The pericarditis may be of a chronic obliterative type, or there may be massive effusion, generally sanguinolent, but rarely purulent. It may be acute, continuing for but a

few days, or chronic, existing for many months. It may be a part of a multiple serositis, and the proportion of cases in which at least one or more of the pleural cavities are involved is remarkable.

The disease is to be regarded as a secondary affection, although, from a clinical point of view, some cases may be looked upon as primary. The point of origin of the infection is often found in the bronchial and mediastinal lymph-nodes, although those may be quite exempt from the disease. The infection may be direct from continuity of tuberculous tissue, or by transmission through lymph vessels or through the circulation. The heart may be greatly enlarged, or normal in size, or even somewhat small. Some observers believe that occasionally the process subsides and that comparative cure results. C. G. Stockton (American Medicine, June 11, 1904).

Its occasional development in cases of chorea brings to mind the mysterious association between rheumatism, chorea, and endocardial disease. Another important cause is chronic nephritis. Gout, scurvy, purpura hæmorrhagica, leukæmia, and cancer also deserve mention. The disease attacks youth and middle life oftener than old age. Addiction to liquor increases the liability to pericarditis. Males are somewhat oftener attacked than females.

By extension from contiguous organs the disease is developed in pleurisy and pleuro-pneumonia, endocarditis, purulent myocarditis, aneurism of the aorta, and also from disease in the bronchial glands, the bones, the œsophagus, and even the abdominal viscera. (Osler.)

Pathology.—The changes in the pericardium due to inflammation correspond closely to those seen in other serous membranes, particularly the pleura. The first change is an injection of the superficial blood-vessels, which may give the whole surface a dull-red color. Fibrinous exudation may consist either of a

few stringy deposits, or a more uniform thin membrane, or, again, a thick, irregular coating. This coating may be ridgy, honey-combed, or shaggy. In chronic cases it may become of enormous thickness, and even present plates of cretaceous material.

In cases of sero-fibrinous exudation the amount of fluid varies between two or three hundred cubic centimetres and two litres. There is a record of the enormous quantity of one gallon. The fluid may be tinged with blood, especially in tuberculosis, cancer, and nephritis. Aged patients are apt to have hæmorrhagic fluid. Purulent exudations consist of a creamy or a thinner sero-pus; in some cases they are offensive: "ichorous."

In cases of rather long duration or great severity the myocardium is involved in the process to the depth of two or three millimetres, entailing an organic weakness which gravely affects the prognosis.

In case the patient survives the disease, permanent changes in the membrane remain behind. There may be small patches of cicatricial change, or a limited number of adhesions, or, again, the pericardial sac may be entirely obliterated, presenting the condition of chronic adhesive pericarditis.

The changes thus far enumerated relate to the inner surface of the pericardium; not infrequently the inflammatory process involves its outer surface as well, giving rise to pleuro-pericarditis and mediastinitis, and eventually binding the heart in an unnatural degree to surrounding parts. (See below: CHRONIC ADHESIVE PERICARDITIS.)

Prognosis.—Acute fibrinous pericarditis is seldom fatal, and most cases of rheumatic origin recover. On the other hand, the disease is very often a terminal phenomenon in patients very ill with certain

diseases, such as nephritis, pleuro-pneumonia, and sepsis.

Tuberculous pericarditis is almost invariably fatal. The rapid outpouring of a large amount of fluid is dangerous from its mechanical effect, and aspiration may then save life if promptly performed. Cases seemingly desperate may recover, even without intervention.

From 100 cases of paracentesis pericardii collected, 38.4 per cent. made complete recovery, the rest dying anywhere from a few minutes to six months or more after the operation. J. H. Burtenshaw (Med. News, Mar. 11, '99).

Treatment.—Pericarditis is not at all a disease in which routine measures are demanded or justified. Some cases, both of the fibrinous and sero-fibrinous variety, may progress to recovery unaided. If there is præcordial or troublesome palpitation, dry cold may be employed over the heart; it should be used at first tentatively. We may employ an ice-bag covered with flannel or Leiter's coil.

Pain may demand an opiate. A fair amount of sleep for the patient is imperative. For this purpose bromide of sodium is useful and paraldehyde seems especially suitable, because it is somewhat stimulating. Robust patients in an abrupt and stormy onset of the disease may be benefited by leeches applied over the heart; but venesection and such cardiac sedatives as aconite are to be avoided.

Some patients obtain more relief from hot than from cold applications. Blisters are to-day little used, although some authorities believe that they hasten the absorption of effusion. Cantharides is contra-indicated in nephritic cases. No internal remedies seem to have any specific effect either in preventing or curing the inflammation.

If, as is likely to happen in the progress of the disease, the pulse becomes irregu-

lar, intermittent, and of low tension, resort must be had to digitalis.

The bowels should be kept open by salines, and acetate of potash may be employed as a diuretic. Moderate amounts of easily-digested nourishment should be given at brief intervals.

One must be guided by the etiological factor. The application of ice, with such quietude of body as can be secured, and the control of the heart by small doses of strophanthus and digitalis is advised. If exploration of the pericardial sac is necessary, the use of careful incision recommended rather than of puncture.

The treatment of pericarditis in children should be directed against the causal and accompanying disease. The excited heart's action is controlled by rest in bed, by strophanthus or digitalis, and by the application of ice locally. Ichthyol ointment (from 20 to 30 per cent.) is useful, and in some cases the old calomel treatment and mercurial ointment may be of value. Surgical treatment may be indicated; in that case incision to mere puncture is preferred. A. Baginsky (Berl. klin. Woch., Nov. 28, '98).

In rheumatic pericarditis the treatment is first prophylactic. While the salicylates do much toward relieving the articular pain, they are of little value in preventing cardiac complications, except in that they shorten the duration of the disease. Small doses of sulphate of quinine may also be valuable as a supportant and prophylactic treatment. After the pericarditis has once been established the chief part of the treatment should consist in local counter-irritation. Plicque (*La Presse Méd.*, June 4, '98).

Prolonged rest in bed (two or three months) after acute cardiac inflammations in children is important because acute cardiac inflammation of a severe type is of much greater gravity in children than in adults. Both the endocardium and pericardium are often simultaneously involved, and there is great tendency to acute dilatation. The cardiac muscle of children is less resistant to strain than that of adults; this renders it liable to acute dilatation, and this

is much encouraged by the concurrent pericarditis. The liability of these attacks to be complicated with pneumonia is also to be remembered. Holt (*Archives of Pediatrics*, vol. xvi, No. 12, 1900).

Sodium salicylate in large doses, given day and night, continued for some time after articular symptoms have disappeared, recommended. In pericarditis without effusion the writer advises scarification, ice and methyl-salicylate locally, and opium, digitalis, milk diet, and perhaps the nitrates internally. Sodium benzoate, theobromine, and normal salt solution enemata or injections may also be of service. After effusion occurs, either venesection, digitalis, theobromine, paracentesis pericardii, or pericardiotomy is resorted to according to the needs of the case. H. Huchard (*Jour. des Praticiens*, Nov. 1, 1902).

It has been stated that rheumatic cases almost always recover; this is true even when large effusions are developed, so that some delay in paracentesis is justifiable here; but in general it is better to be prompt in the removal of any large effusion. One purpose of this is to relieve the heart of mechanical embarrassment, and another is to discover the character of the effusion, for purulent pericarditis has a better chance of recovery if permanent drainage is early established. For other particulars with regard to aspiration see DIAGNOSIS.

Several surgeons have made independent studies of the best method for draining the pericardial sac. In a general way it may be said that an important point is to avoid opening the pleural cavity, which might cause pneumothorax or empyema.

The fourth (Porter), fourth and fifth (Roberts), or fifth and sixth (Delorme) costal cartilages near the sternum may be resected, the pleura and the internal mammary artery being drawn toward the left, and the pericardium thus exposed.

It is clearly the duty of the surgeon, whenever death is imminent from cardiac pressure, to resort to tapping. The operation is not attended with great danger, and in cases of effusion from rheumatic pericarditis there is every prospect of recovery. A. Meldon (*Brit. Med. Jour.*, Dec. 12, '96).

Further evidence adduced in favor of personal contention that pericardial effusions should be treated in the same manner as pleural effusions, paracentesis being insufficient to cure suppurative pericarditis. Incision and drainage are essential, and should be executed as soon as the diagnosis of pus in the pericardium is made. The diagnosis of the purulent character of the effusion is determinable only by exploratory puncture. This should be done at the upper part of the left xiphoid fossa, close to the top of the angle between the seventh cartilage and the xiphoid cartilage. Pericardiotomy should then be done after resection of the fourth and fifth costal cartilages, raising a trap-door of these cartilages and using the tissues of the third interspace as a hinge. The mammary vessels and pleura are thus exposed and pushed to the left. The prognosis is good after pericardiotomy for pyopericardium. List of 26 collected cases showing 10 recoveries and 16 deaths. Of the fatal cases, 9 were septic, and all the others which died had complicating lesions,—pulmonary, cardiac, or renal. J. B. Roberts (*Med. News*, May 8, '97).

Study of the anatomy of the parts upon 100 cadavers, showing that beneath the sternum there is always an area of cellular tissue with definite boundaries. There is an expansion of this cellular space at its superior and inferior portions which are connected by a more or less constricted link. The inferior portion lies beneath the costo-sternal junction of the sixth and seventh ribs, and a portion of the sternum adjacent thereto. The lower boundary corresponds to the base of the pericardium. By removing this portion of the sternum and sections of the sixth and seventh ribs at their costo-sternal junction the safest and surest approach to the pericardium is

obtained. At this point there is no danger of injuring the diaphragm or pleura, and the internal mammary, lying to the outer side, can be avoided. The guide to the incision should be the tubercle of the left sixth sterno-costal articulation. The incision should be parallel to the axis of sternum, about six or eight centimetres long, and should traverse the tubercle of the sixth rib at its junction with the sternum. Voinitch-Sianojensky (*Revue de Chir.*, Nov. 10, '98).

Pericardotomy is indicated in all cases of suppurative pericarditis. Because of the uncertain and varying relations of the pleura, and because of the anterior position of the heart, whenever the pericardial sac is distended by fluid, aspiration of the pericardium is a more dangerous procedure than open incision when done by skilled hands. Incisions of the pericardium can be done quickly and safely by resection of the fifth costal cartilage, and in many cases under local anæsthesia. In many cases of serious effusion open incision without puncture will offer less risk and speedier cure than aspiration. C. B. Porter (*Boston Med. and Surg. Jour.*, Oct. 18, 1900).

Purulent pericarditis is quite frequently overlooked in lobar pneumonia and in other pyæmic states. Its presence modifies the pre-existing disease to a considerable extent. In diseases with high temperature the presence of purulent pericarditis depresses the fever range and increases the respiratory and pulse rate without sufficient clinical evidence of trouble elsewhere than in the pericardium.

It is yet to be proved that the heart, in case effusion is present in the pericardium, is always dislocated backward and upward. It is probable that in some cases the presence of fluid in the pericardium dislocates the heart either to the right or to the left. (This, of course, will occur if previous adhesion between the heart and the pericardium has occurred on either the right or the left side.)

The diagnosis once made, the only treatment should be incision and thorough drainage. (Paracentesis will at times relieve temporary urgent symp-

toms, and should be performed without the slightest fear.) Exploratory puncture can be made with safety, and is essential for diagnostic purpose before operation is undertaken. Such puncture should be made in the fourth or fifth left intercostal space, as close to the sternum as possible, with a fine needle.

Pericardial dilatation does not alter the relations of the pleuræ to the anterior thoracic wall. In the presence of pyopericarditis the overlying pleural space is usually obliterated by extension of the inflammation.

Incision under local anaesthesia is the preferable operation in the majority of cases. Roberts' chondroplastic flap is preferable to an ordinary excision of costal cartilages when incision fails to give adequate drainage. J. A. Scott and Robert G. Le Conte (*American Jour. Med. Sci.*, Sept., 1904).

Chronic Adhesive Pericarditis (External Pericarditis; Pleuro-pericarditis; Mediastino-pericarditis).

The obliteration of the pericardial sac may not embarrass the heart's action in any important degree. If, however, the adhesions are formed at a time when the heart is dilated, the heart cannot easily regain its normal size, and is apt to become incompetent. If the external surface of the pericardium, as well as the internal, forms unnatural adhesions, the condition is far more serious.

Diagnosis.—In many instances internal adhesions are not capable of demonstration, although they may be suspected if there is rapid heart-failure after an attack of pericarditis. External adhesions may cause abnormal motions of the thoracic walls. Systolic retraction of the thorax in the neighborhood of the apex-beat is particularly characteristic; there may also be an epigastric retraction, and one at the seventh and eighth ribs near the left edge of the sternum. It has also been stated that laterally and posteriorly there may be a similar systolic depression at the base of the left chest. In some

cases the *pulsus paradoxus* is produced, namely: the radial pulse becomes feebler or intermits with every inspiration.

The veins in the neck sometimes exhibit a diastolic collapse, being at other times overfull. Much value is placed upon the diastolic shock, or rebound, which may be felt on placing the hand over the heart's apex.

Other points are the wide extent of the cardiac dullness and of visible cardiac motion, and the fixity of the apex-beat without regard to alteration of posture or respiratory influences.

The discovery of this condition is valuable only as a means of prognosis, the treatment being *nil*. The embarrassed heart may be stopped in a sudden fatal syncope, or go through the more gradual changes of ruptured compensation. Sometimes chronic mediastinitis extends through the diaphragm, in children, and gives rise to perihepatitis, perisplenitis, and chronic ascites.

Hydropericardium.—In dropsy of the pericardial sac it is usual to find post-mortem a teaspoonful or two of serous fluid in the pericardium which probably transudes after death. Larger quantities may form during life as a result of chronic heart disease, emphysema, and more often chronic nephritis. In these cases there is no friction-sound nor other evidence of inflammatory change. The symptoms are usually merely those of the causative condition, although, of course, a large amount of fluid may add to the embarrassment of the heart.

The prognosis and treatment are directed to the underlying disease, and it is rarely necessary to aspirate.

Hæmopericardium.—Blood in the pericardial sac is a rare condition which may be caused by aneurism of the aorta, aneurism of the coronary arteries, and by trauma. Death is usually too prompt for

any treatment, and diagnosis is rarely possible. In a few traumatic cases aspiration has been successfully carried out.

Pneumopericardium.—Air in the pericardial sac may be caused by perforating glands, and by the perforation of some lesion in the lungs, œsophagus, or stomach.

There is almost always a purulent exudation in addition to the gas present; rarely there may be merely a sero-fibrous fluid.

The auscultatory signs of such a condition are striking; the sounds take on a metallic character, and there may be a splashing audible even at a distance. The areas of tympany and of dullness, respectively, will be changed by altering the patient's posture. Treatment is the same as for a severe attack of ordinary pericarditis. The prognosis is extremely grave.

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PERITONEUM, DISEASES OF THE.

Acute General Peritonitis.

Symptoms.—Acute general peritonitis is usually of sudden onset and is ushered in by rigor, chill, and high fever. There is intense pain in the abdomen, which is sometimes localized, but usually soon becomes general. The pain, when localized, is often in the region of the disorder acting as primary cause. When due to a ruptured gall-bladder, it is located in the right hypochondrium; when a ruptured gastric ulcer is the cause, it occupies the region of the left hypochondrium or the back between the shoulder-blades. A ruptured appendix vermiformis or a peritonitis caused by disease of the appendix causes intense pain, which, when localized, is in the right iliac fossa. The pain, however, is frequently at the umbilicus and

not seldom in the left iliac region. (See APPENDICITIS.)

The pain of an acute general peritonitis, if at first localized, soon becomes general. It is aggravated by movements and by pressure. The patient lies on the back or the side with the legs drawn up. The face is blanched and haggard and the expression anxious. These are the symptoms at the beginning, during, and shortly after, the chill. The temperature at this time may not be much elevated. Occasionally, if the shock is very great, it may even be subnormal. The pulse is thready and rapid. Vomiting is an early and very painful symptom.

Acute diseases of the abdominal viscera and, in particular, perforation of the stomach are often accompanied by thoracic pain, either dorsal, scapular, or intrascapular. In general peritonitis this symptom is of great importance. M. J. L. Faure (*La Semaine Méd.*, Jan. 23, 1901).

Patients with general or rapidly spreading peritonitis have constantly, at least in the early period, abnormally high blood-pressures. In perforative peritonitis a sharp rise in blood-pressure may precede the onset of other symptoms. In doubtful cases, where perforative peritonitis is suspected, and the general previous blood-pressure level is known, the course of the blood-pressure after the onset of grave symptoms should receive consideration in determining the propriety of operation. J. B. Briggs (*Boston Med. and Sur. Jour.*, Sept. 24, 1903).

Soon, however, the symptoms of acute septic poisoning begin, and we have an entirely different clinical picture. The face, while still drawn and pinched, is less pale; the expression is of great suffering and absolute helplessness; the pulse is fuller, though weak and more rapid, 120 to 140; the temperature is high, 102 to 104 or over; the skin is dry; the abdomen is distended and tympanitic. The area of liver-dullness is

generally obliterated in the mammary and middle lines, and there is intestinal paresis. The urine is scanty and the bowels constipated; the skin may be dry or bathed in sweat. An effusion of fluid is usually present at some stage of the disease and can be demonstrated in the flanks, which are dull on percussion. The patient presents all the symptoms of septicæmia, and is gradually overwhelmed by the toxins of the organisms which are the cause of the inflammatory process.

Diagnosis. — The diagnosis of acute general peritonitis is not always clear at first, but, as a rule, it is made from the history and the sudden onset of the symptoms. The primary source of the infection determines the treatment, and must be diligently searched for. This disease simulates several other conditions. The more common of these conditions are: enterocolitis, obstruction of the bowel, hysterical peritonitis, rheumatism of the abdominal walls, local circumscribed peritonitis, and tubercular peritonitis. In enterocolitis the pain is less severe and more spasmodic in character, the distension of the abdominal walls is not so great as in acute peritonitis, and the dyspnœa is less severe. In enterocolitis there is usually diarrhœa, whereas constipation is common in peritonitis.

Acute peritonitis is to be distinguished from **INTESTINAL OBSTRUCTION** by the absence of stercoraceous vomiting and tumefaction above the seat of obstruction.

The differential diagnosis between acute septic peritonitis and acute mechanical obstruction is always difficult, and oftentimes impossible, without an operation. But perhaps the following slight differences may help in making the diagnosis: 1. The intestinal obstruction is more often absolute in mechan-

ical obstruction. 2. The vermicular movements persist for some time, and may be increased in mechanical obstruction. 3. The pulse has a good volume, and is not markedly accelerated in mechanical obstruction. 4. Fluid does not collect in the pelvis in mechanical obstruction, and evidences of inflammation of the appendix, Fallopian tubes, gall-bladder, and so forth are wanting. 5. Elevations of temperature are less common in mechanical obstruction. 6. Fæcal vomiting occurs earlier in acute mechanical obstruction.

Laparotomy may have to be done as a final step in the diagnosis C. B. Lockwood (Clin. Jour., Apr. 1, '96).

TUMOR is frequently present in cases of acute peritonitis, and the location and character of the tumor determines the diagnosis. Examples of such cases are appendiceal abscesses, ovarian cysts with twisted pedicle or other ovarian tumors undergoing malignant or degenerative changes, extra-uterine pregnancies; biliary, splenic, or perinephritic abscess, etc.

HYSTERICAL PERITONITIS occurs occasionally in patients of nervous temperament, and may so closely simulate acute peritonitis as to make the differential diagnosis difficult. There is, however, complete absence of cause, and no disease of the abdominal viscera can be discovered.

RHEUMATISM OF THE ABDOMINAL WALLS is generally accompanied by symptoms of rheumatism elsewhere.

LOCAL CIRCUMSCRIBED PERITONITIS may give rise to the symptoms of a general peritonitis. The disease becomes localized by reason of a rapid adhesive inflammation shutting off the general peritoneum. This often follows ulceration of the stomach and other abdominal viscera. The most frequent seat of local or circumscribed peritonitis is in the right iliac fossa, due to perforation of the appendix vermiformis subsequent

to catarrhal ulceration of the same. Disease of the Fallopian tubes is frequently the cause of localized peritonitis. A general acute peritonitis may follow any of these forms of localized peritonitis, with abscess-formation, by reason of a gradual extension and burrowing of pus in various directions and so infecting the general peritoneal cavity. (See second colored plate in the article on APPENDICITIS, volume i.)

Signs of most value in recognizing typhoid perforation are sudden, acute abdominal pain, collapse, and abrupt and decided fall of temperature. Vomiting is often present. The obliteration of liver-dullness, the gurgling sound on respiration, hiccough, etc., are valuable signs when present. As a rule, perforation is quickly followed by symptoms of peritonitis. The streptococcus pyogenes is usually found in numbers in the exudate of perforative peritonitis. J. N. T. Finney (Annals of Surg., Mar., '97).

Personal case in which erysipelas was the cause of infection. M. H. Richardson (Boston Med. and Surg. Jour., Sept. 8, '98).

Etiology and Pathology.—The surface of the peritoneum, we are told, is as large as that of the integument of the body; in its reduplications and folds it partially surrounds all the abdominal organs and viscera. It is, therefore, exposed to infection on all sides. The infection is always one or several forms of micro-organism which gain access to the peritoneal cavity. The pathogenic germs which most commonly give rise to peritonitis are the bacillus coli communis, the staphylococci aureus and albus, bacillus pyocyaneus, the streptococcus pyogenes, the gonococcus, and the tubercle bacillus. The infection is not always a pure culture, but is usually mixed; several forms of pathogenic micro-organisms being present.

Bacteriological classification of peritonitis: (a) Streptococcic infection. The streptococcus pyogenes is the microbe which is most frequently found in the tissues in cases of septic peritonitis. The infection spreads so rapidly over the peritoneal surface and through the subserous lymphatics that death, as a rule, occurs from septic intoxication before a sufficient length of time has elapsed for any gross pathological lesions to form. Absence of fibrinous exudate and effusion are the most striking negative findings at operations and necropsies.

(b) Staphylococcic infection. In peritonitis caused by staphylococcic infection the intrinsic tendency to localization of the disease is more marked. As a rule, the inflammation terminates in the formation of thick, cream-colored pus.

(c) Pneumococcic infection. The diplococcus occasionally is found as the bacteriological cause of acute suppurative peritonitis.

(d) Bacillus - coli - commune infection. The bacillus coli commune is, in a fair percentage of cases, the bacteriological cause of acute peritonitis. This microbe possesses pyogenic properties, and in intestinal paresis and perforations escapes into the peritoneal cavity, and usually produces a pathologically mixed form of peritonitis; that is, suppurative and fibrinoplastic peritonitis.

(e) Gonococcic infection. In the peritoneal cavity the gonococcus produces a plastic peritonitis, and sometimes localized suppuration. Salpingo-peritonitis and the more diffuse pelvic peritonitis is most frequently caused by gonococcic infection.

(f) Tubercular infection. The rapid diffusion of the tubercle bacillus in the peritoneal cavity occasionally gives rise to a form of acute peritonitis characterized as such in a modified way by the clinical manifestations which accompany it. According to the intensity of the infection or the degree of susceptibility of the patient to the action of the tubercle bacillus, the disease assumes one of the following pathological forms: (1) tubercular ascites; (2) fibrinoplastic peritonitis; (3) adhesive peritonitis. Suppuration takes place only when the

tubercular product becomes the seat of a secondary mixed infection with pus microbes. N. Senn (Med. News, May 8, '97).

Avenues for the entrance of bacteria into the peritoneum: Any injury or disease of the alimentary canal sufficiently intense to cause a perforation, notably appendicitis, and less frequently ulcers; any obstruction—such as invagination, intussusception, or strangulated hernia—which causes a necrosis of the gut; septic conditions of the abdominal or pelvic organs—such as abscess of the liver or kidneys, and especially disease of the Fallopian tubes—giving rise to pelvic peritonitis; septic conditions of the post-partum uterus giving rise to puerperal metritis, this latter often being classified under a distinct heading; traumatism from within or without the lumen of the bowel, or traumatism to the abdominal wall. C. D. Hill (Med. News, Aug. 17, 1901).

Two cases of pneumococcus peritonitis, making 72 now on record. The writer calls attention to the fact that the fluid in the peritoneal cavity is usually thick and fibrinous and that it tends to become encapsulated, thus rendering the prognosis favorable. These collections of fluid are most often found in the neighborhood of the umbilicus and in the iliac fossæ. The abdominal viscera are seldom involved, but the lungs, pleura, meninges, and pericardium are frequently affected.

The disease is most common in girls under fifteen years, beginning as a pneumonia, followed by increased temperature, abdominal pain, vomiting, and diarrhoea. The process is soon localized in the abdomen, and persists for several weeks, with variable temperature, moderate pain, and gradual loss of strength. The fluid may be evacuated spontaneously, but surgical intervention is preferable. In adults the diagnosis is more difficult, as it is liable to be mistaken for typhoid or tubercular peritonitis. It is characterized by an acute onset, followed by localization in the abdomen. Early incision and drainage are indicated. V. Brunn (Beitrage z. klin. Chirurgie, Bd. xxxix, Ht. 1, 1904).

The most frequent source of infection is from the intestine, caused by the migration of the bacilli coli communis through inflamed intestinal walls or directly through a rupture caused by traumatism or perforating ulcer.

Peritonitis is frequently caused by extension of inflammation from the various abdominal organs and by perforation in some part of the intestinal tract, as in gastric, typhoid, tubercular ulcers or perforative appendicitis, or perforating diseases of the gall-bladder. It may follow inflammation or disease of the pelvic viscera, as shown in many cases of salpingitis, extra-uterine pregnancy, and septic metritis. The primary inflammation in the various organs or viscera is always caused by a micro-organism, and the peritonitis which follows, to extension of the infection. The bursting of abscesses into the abdominal cavity from the liver, the spleen, or the kidneys is another cause of peritonitis. Gonorrhœa may cause peritonitis by extension of the infection through the uterus and Fallopian tubes.

Diseases in which acute general peritonitis may arise are as follow (they do not include the traumatic and gynæcological cases): 1. In the alimentary canal: (a) peptic ulcer, gastric and duodenal; (b) enteric fever; (c) appendicitis. 2. Other hollow viscera, the contents of which may be infected: (a) the gall-bladder; (b) the pelvis of the kidney; (c) the urinary bladder. 3. Rupture of abscesses: (a) purulent pleurisy; (b) subphrenic abscess; (c) hepatic abscess; (d) abscess of the pancreas; (e) appendicular abscess, and (f) other pus collections in regions in relation with the peritoneum. 4. Necrotic processes involving abdominal viscera: (a) internal strangulation; (b) intussusception; (c) volvulus; (d) embolism and thrombosis of the mesenteric vessels; (e) gangrene of the pancreas or of the spleen; (f) displaced kidney or spleen with twisted pedicle; (g) acute

hæmorrhagic pancreatitis; (*h*) fat-necrosis. J. C. Wilson (Jour. Amer. Med. Assoc., July 9, '98).

Traumatic peritonitis occurs as the result of cold or injury by wounds or blows and occasionally as the result of caustic poisons.

The intestines are distended, congested, and more or less matted together, while the peritoneum is opaque and lustreless. As in inflammation of other serous membranes, so in inflammation of the peritoneum may be found the fibrinous, sero-fibrinous, purulent, putrid, and hæmorrhagic forms of exudation.

Treatment.—The treatment of acute peritonitis is both medical and surgical. The old form of medical treatment by opium narcosis, small doses of calomel, and applications to the abdomen has been abandoned. Our present knowledge of the etiology and pathology does not admit of it. In fact, opium should seldom be used in peritonitis except occasionally for the relief of great pain and in some cases of peritonitis due to sudden rupture of gastric or intestinal ulcer when the object is to put the stomach and intestines at rest and so prevent peristaltic action and the further leakage of intestinal contents into the general peritoneal cavity. Operation should follow as soon afterward as possible. The later form of medical treatment in peritonitis not due to perforation is by saline catharsis and the application of cold to the abdomen. The saline is given in concentrated solution in doses of 1 to 2 drachms every two or three hours until several copious discharges occur daily.

In cases of threatening acute septic peritonitis administration of saline cathartics (magnesium sulphate, 30 to 60 grains) advised. Opium ought not to be given in these cases. Opium should be administered in all cases of peritonitis which are due to perforation. Stimu-

lants should be freely given by the mouth or the rectum, and, if they are not readily retained, they should be administered by injection. Early operation advocated in all cases of acute septic peritonitis. Senn (Brit. Med. Jour., Sept. 4, '97).

Many cases of threatened peritonitis aborted after abdominal section abated by the timely administration of saline cathartics. Tait's plan was to give 30 or 40 grains (2 or 2 $\frac{2}{3}$ grammes) of sulphate of magnesia, repeated every hour or second hour until the bowels moved freely. Sometimes when the stomach is intolerant it will be found expedient to resort to small doses of calomel, repeated each hour for a number of times. Coincidentally saline rectal injections can be employed with benefit. Senn (New England Med. Jour., July, 1902).

Even in aseptic cases, to a limited extent there will be found the cardinal symptoms of inflammation localized about the field of operation. This reaction is always present and is apparently due solely to traumatism. Some of the cases may be septic, and the inflammation may spread to the peritoneum. Post-operative peritonitis may often be prevented or controlled by the proper use of ice, when localized and consequent upon inflammatory affections of the pelvic organs. In several hundred of these cases personal mortality has hardly exceeded 1 per cent. Ice-bags are placed on the abdomen of patients in whom it is feared that peritonitis might develop. Simpson (Amer. Jour. of Obstet., Nov., 1902).

In connection with this treatment, the employment of decinormal salt solutions by intravenous injections or by hypodermoclysis has been highly recommended and undoubtedly gives most excellent results. This latter measure is particularly useful in puerperal peritonitis, when it should be used in conjunction with frequent intra-uterine irrigations.

Continuous irrigation with warm normal salt solution may prove valuable in the treatment of heretofore fatal peri-

tonitis. The peritoneal cavity stands, with perfect safety, a continuous irrigation with normal salt solution at a temperature of 100° F. during 74 hours. The infection may entirely cease, together with pain, vomiting, and distension. The irrigation was comfortable, and no complaints were made. The copious irrigation should dissolve and carry off the toxins as they are formed and, reaching the more dependent portions of the peritoneal cavity, remove infectious material; effectual drainage would ensue. It acts as a tonic to the heart, some being doubtless absorbed into the system. The irrigation was carried out through an incision in the abdominal wall and with success in an apparently hopeless case. Ernest Laplace (Phila. Med. Jour., Oct. 14, '99).

Plan for the gradual introduction of saline solution into the peritoneal cavity after severe operations: before closing the wound a No. 18 catheter is inserted at the lower angle and carried down into Douglas's pouch. The wound is sutured in the usual manner, and the catheter is cut off and its end secured with a wire suture and attached to a glass irrigator. After the dressings have been applied a continuous flow of saline solution is begun and maintained for twenty-four hours at the rate of one cubic centimetre a minute. This is effected by compressing the supply-tube with a clamp fitted with a millimetre-screw. About 3 pints of fluid are introduced in twenty-four hours. Eichel (Archiv f. klin. Chirurgie, B. 58, H. 1, 1900).

Three quarts of saline solution were injected into the peritoneal cavity in two days in a case of rupture of the liver, with profuse hæmorrhage, in which fully two quarts of blood had been lost. Eichel (Archiv f. klin. Chir., B. 58, H. 1, 1900).

The use of salt solution does not increase, but unquestionably minimizes, the dangers of pyogenic infection. In addition to the reduction of mortality, the convalescence of the patient is rendered infinitely more comfortable and satisfactory through the reduction of thirst, the increase in the urinary excretion, and the minimizing of vesical

irritation. Clark (Jour. of the Amer. Med. Assoc., Jan. 30, 1904).

Vomiting can usually be controlled by ice and small quantities of soda-water or iced champagne; if, however, it persists, all nutriment should be given by means of rectal enemata. In distressing tympanites the long rectal tube and injections containing turpentine may prove of value.

Antistreptococcic serum has been tried with apparently good results, but the evidence so far adduced is not sufficient to warrant any conclusion as to its merits.

Case in which the antistreptococcic serum acted as follows: Temperature and pulse-rate were uniformly lowered after each administration; elimination of waste, infectious products was favored; pus-production was checked. Grandin (Med. Rec., Apr. 3, '97).

The surgical treatment of acute general peritonitis carried out with proper technique and thoroughness has given the most brilliant results. The incision will depend upon the location of the cause of the peritonitis. Where the cause cannot be determined, the incision should be in the middle line. In other cases the position of the incision depends upon the location of the cause. The incision should always be large enough to admit the hand of the operator and, if necessary, for purposes of drainage, several incisions may be made. Vaginal incision is nearly always necessary in these cases when the cause of the peritonitis is due to disease of the uterus, tubes, or ovaries. The incision having been made and the exciting cause found, it should be removed if practicable. The vermiform appendix should always be removed in appendiceal cases when it is possible to do so. The pus or serous fluid should be allowed to escape, and

the intestines be delivered and supported in clean towels rung out of sterile hot salt solution. They should be *gently* examined coil by coil and thoroughly cleansed by irrigation or sponging with hot salt solution. If the intestines are much distended and filled with fluid fæces, they should be incised in some convenient place and the gas and fæces allowed to escape, after which the incisions must be closed with Lembert sutures. Every part of the abdominal cavity must then be thoroughly cleansed by irrigation or mopping. The intestines are then returned and drainage established by gauze, the ends of the drains being so placed above, below, and between the coils of intestines as to drain every portion of the peritoneum. The incision or incisions are then approximated by silk-worm-gut sutures, taking care not to close tightly in the position of the drains. Many operators advise leaving as large a quantity of salt solution in the abdomen as possible before closing the wound. It seems to prevent or minimize shock and to promote absorption. It also seems to act as a circulatory stimulant. It is often advisable, in these cases, before the patient comes out of ether, to give high rectal enemas of hot salt solution. The quantity should be about 1 quart and the temperature from 105° F. to 110° F. During the first twenty-four hours the patient should be freely stimulated with whisky, and strychnine employed hypodermically. Rectal alimentation may begin early and be gradually replaced by mouth-feeding as soon as the condition of the wound warrants it. As soon as the stomach will permit of it, calomel should be given in divided doses, followed by small doses of salts and enemas until the bowels are freely opened and all distension disappears.

In septic peritonitis the incision should be made in the middle line, or elsewhere, if perforation is suspected, but in every case it should be large enough to allow the ready insertion of the surgeon's hand into the peritoneal cavity. All exudation should be removed from the peritoneum by sponging, irrigation with hot (110° F.) sterile solutions, or by turning the patient into the prone or semiprone position and allowing it to drain out. When the intestines are distended, it is often advisable to make small incisions into them, or to puncture with a needle. Incisions are afterward sewn up. Free drainage should be established. Usually capillary drainage is the more satisfactory. Plain sterilized gauze should be covered with one or two layers of iodoform gauze, so as to avoid the occurrence of iodoform poisoning. Drainage should be dispensed with as soon as possible, and should be left off gradually. Before closing the external wound it may be advisable to inject a strong solution of a saline cathartic into the lumen of the intestine through the walls. Senn (Brit. Med. Jour., Sept. 4, '97).

In operation of acute general peritonitis, when only the lower segment has as yet been invaded, the presenting bowels are mopped with sponges in clamps, dripping wet with hot salt solution (1½ drachms to a quart), and dried again before other coils are drawn into the field of inspection. As soon as parts are found not much inflamed, a sterilized-gauze tamponade, properly folded, is pushed among the bowels far away from the field of work. This has a tape sewed to it, to which a clamp is fixed and left outside the wound. One or two such tamponades may be thrust upward and across the abdomen before the pelvis is cleansed. This being thoroughly mopped out, a light packing of mild iodoform gauze is to be placed in the pelvis, and a short way among intestinal coils elsewhere. The abdominal wound should never be closed in any septic case. In the grave cases, a long, median incision, or two lateral ones, will always be needed. The lumbar-drainage incision will not be necessary when the median cut is used. Drainage with

ample gauze packing is to be used. When infection has been wide-spread, irrigation should be used, the interintestinal spaces being flushed systematically with hot salt water, as hot as the operator's hand can bear (which will be over 105°, usually). If the intestines are distended with gas and fluid fæces, it is well to let them come out of the abdomen, receive them in hot towels in charge of an assistant, and prick one or two prominent places with a knife to evacuate gas and excreta, which is washed away with a constant hot stream. Through one opening there should then be injected a syringe-ful of saturated solution of Epsom salts and the puncture closed. In regurgitation, lavage of the stomach should be done before and after operation, and repeated as soon as regurgitation is renewed. Rectal tube to relieve distension by gas is of inestimable value. An ice-coil, or light, broad ice-bags after a general peritonitis retards the inflammatory action and bacterial growth either before or after operation. Strychnine, $\frac{1}{40}$ grain every 2 hours, is sometimes necessary, and in cases of severe pain when the patient is well out of ether, morphine, hypodermically. Abbe (Med. News, May 29, '97).

In order to establish free drainage of the intestinal canal in grave forms of peritonitis complicated with paralysis it might be advisable to make one or more openings in the distended intestine, care being taken by packing that the discharges from these openings be prevented from coming into contact with the peritoneum or the external wound. Three cases of acute septic peritonitis, in which this treatment was followed by good results. In two of these, inflammatory mischief had been set up by appendicitis. If in any case of acute peritonitis treated by laparotomy the distension and paralysis of the bowel be not complete, it might be found beneficial to leave some distended intestine in the external abdominal wound, and to suture it there, so that at any subsequent time if the bowels be not moved, or if the symptoms of septic absorption continue, artificial

openings may be made. Van Arsdale (Annals of Surg., Jan., '99).

Nine cases of diffuse septic peritonitis treated by elevated posture of the head and trunk and drainage after operation. Recovery in all. In an equal number of cases of diffuse septic peritonitis subject to the same measures of treatment, but without the elevated head and trunk posture, four recovered and five died. This is due to the fact that the pelvic peritoneum absorbs less readily than the upper peritoneal structures. G. R. Fowler (Med. Record, Apr. 14, 1900).

The majority of cases follow perforation of an ulcer in the small intestine. A diffuse, purulent peritonitis follows, which causes death in 95 per cent. in three to six days. Of 90 cases of perforation surgically treated, collected from literature, 16 recovered: *i.e.*, 21.6 per cent. Perforation generally occurs in the second, third, or fourth week, and cases operated within twenty-four hours after perforation has occurred usually recover. E. Loison (Revue de Chir., Feb., 1901).

The main point in perforative peritonitis in typhoid is the difficulty of diagnosis. He notes a case in which there had been sudden abdominal pain, great tympany, and other evidences of perforation which had subsided within a short period, and he believes there had not been a perforation. He observed, in one instance, pain referred to the end of the penis. James Tyson (Jour. Amer. Med. Assoc., Feb. 16, 1901).

There may be difficulty in finding a perforation during an operation for perforative peritonitis. In one instance personally operated on a patient with typhoid fever under the impression that there was a perforation, but none could be found. In this instance the patient made an uneventful recovery and stood the operation well. Simple flushing out of the abdominal cavity seems to do good. G. G. Davis (Jour. Amer. Med. Assoc., Feb. 16, 1901).

Operation gives no prospect of recovery except when the general sepsis is not far advanced. As in the treatment of abscesses in general it is important to remove the pus and to prevent its ac-

cumulation again, so in general peritonitis. The best method of doing this is drainage from the lowest point—the pelvis. This part, however, only remains the lowest point so long as the patient is kept in the most upright position. The Douglas pouch is drained through the vagina, and in men through the perineum. The patients are supported by bands, and are kept upright day and night and washed out through the drainage tubes every two hours. Hr. Langanbuch (Medical Press, April 3, 1901).

Results obtained in 100 well-marked cases of diffuse septic peritonitis resulting from inflammation of the vermiform appendix. The cases were treated by the author and by George R. Fowler. Sixty-seven of the cases recovered. Of the 33 deaths, 17 occurred within twenty-four hours of operation. The salient points in the treatment of these cases were: A small incision and the avoidance of eventration, thorough cleansing of the primary focus of infection and removal of the appendix. Evacuation and cleansing of all accessory abscess cavities and the pelvis before washing out the peritoneal cavity. A rapid systematic flushing of the peritoneal cavity with sodium peroxide solution, followed by hot saline. The continuance of the saline flushing until the sutures are placed, and for the most part tied. The provision of proper drainage for the pelvis, either by means of a large glass tube containing a capillary drainage strip emerging through the lower angle of the wound, or, in females, by a large caliber rubber tube filled with wicking, passed through a posterior colpotomy incision. The drainage of accessory abscess cavities with gauze or wicking. The elevation of the head of the bed to accelerate the drainage of septic fluid into the pelvis where it can be removed through the glass tube, or, in case of vaginal drainage, find a ready exit. R. S. Fowler (Med. News, May 28, 1904).

An important feature of all operative measures instituted is that all manipulations of the intestine should be attended

with the greatest possible gentleness, in order to avoid local complications leading to intestinal obstruction (*q. v.*). This should not, however, prevent the thorough removal of all exudates: a feature of the operation upon which its success depends.

Peritonitis in Infants.

Symptoms.—The symptoms of acute peritonitis in the newly born are often obscure and may not be recognized during life. The onset is sudden, with vomiting and high temperature: 103° to 105° F. The abdomen, at first normal, soon becomes swollen and tympanitic. Upon the occurrence of this symptom the diagnosis is established. The pulse is small and rapid, respirations hurried, and there is great prostration. There may or may not be diarrhoea. Retention of urine is common, yet there may be frequent micturition. The infant is rapidly overwhelmed by the toxins of streptococcic infection.

Etiology.—According to Holt, peritonitis is quite frequent in the newly born. It is a streptococcic infection, occurring as the result of sepsis in the mother, and is often the cause of death. The avenue of infection to the infant is the umbilical cord. The disease may be either local or general. When local it is usually in the neighborhood of the umbilicus or the liver. As in the adult, it results in adhesions or else in peritoneal abscess-formations. Should the infant survive, the resulting adhesions may cause an arrest or an alteration in the development of some part of the intestinal tract. Peritonitis is not uncommon in foetal life. It is probably the cause of those cases of congenital malformations and atresias of the intestines which are sometimes met with. Cases of imperforate anus and stricture in various

parts of the intestinal tract are accounted for in this manner.

The records of the Moscow Lying-in Asylum show that in 75,000 autopsies on infants there were 36 cases of congenital atresia of the digestive tract: 21 in boys and 15 in girls. In 11 the occlusion was situated in the ileum, in 8 in the rectum, in 7 in the duodenum, in 5 in the jejunum, in 3 in the œsophagus, and in 2 in the colon. In most of the cases there had been a distinct history of peritonitis during intra-uterine life. From these *data* it was concluded that peritonitis was the most frequent cause of the atresias of the alimentary canal in the newborn. Miller (Brit. Med. Jour., Sept. 22, '94).

Among the causes are intestinal obstruction from volvulus, intussusception, strangulation from any cause, and congenital atresia. Appendicitis is a frequent cause in young children. Occasionally it is seen in connection with pneumonia and scarlet fever. It may be caused by extension of inflammation and burrowing of pus through the diaphragm from an empyema. These cases are to be treated according to indications.

Peritonitis is rare during infancy and early childhood until the fifth year. In the newly born it occurs in either the acute or chronic form. When acute it is usually a general infection of the peritoneum with the production of serum, lymph, and pus. When it assumes the chronic form, the process is a localized one with abscess-formation. The acute form is almost invariably fatal, death occurring on the second or third day.

Treatment.—The treatment is most unsatisfactory, since the cases usually terminate fatally. It is well to begin with a laxative, either a saline or castor-oil, and to follow this up with drop doses of paregoric. Cold applications to the abdomen, either by ice-bag or coil, have been advised, though most children bear

it badly. In these cases hot applications must be substituted. The infant should be freely stimulated with brandy in small and frequently-repeated doses. Feeding by the mouth is most difficult to accomplish by reason of the vomiting. It may be attempted by small doses of some of the prepared foods. Panopepton (Fairchild) in 10- or 15-drop doses every hour will often be well borne. Surgical interference in cases of acute general peritonitis of the newly born due to streptococcic infection is of no avail. In local peritonitis with abscess-formation incision or drainage is always indicated.

Chronic Peritonitis.

Symptoms.—Chronic peritonitis may be either local or general. In the local form the symptoms are, as a rule, latent, but colicky pains, which are quite severe, are sometimes present. Palpation and percussion seldom reveal anything definite, although there may be felt, in some cases, an ill-defined mass at the point of greatest pain.

The diffuse form may also progress with no definite symptoms, the patients appearing to be in perfect health even with a comparatively enlarged abdomen. In other cases, however, there are gastrointestinal disturbances, as loss of appetite, constipation, or sometimes diarrhœa, the patients gradually becoming greatly emaciated and anæmic. Slight fever may or may not be present. Examination of the enlarged abdomen will often reveal fluctuation, if the fluid is not capsulated, while in other cases hard, rounded masses caused by the thickened omentum and fibrous bands may be detected by palpation.

Etiology and Pathology.—Several varieties of chronic peritonitis may be recognized, of which the following are the most important (a) local adhesive, (b) diffuse adhesive, (c) proliferative, (d)

chronic hæmorrhagic, and (e) tuberculous, which will be treated separately.

Chronic local adhesive peritonitis is usually the result of an acute localized attack and is situated most commonly in the region of the appendix, spleen, and liver. In such cases adhesions are found, especially between the two latter and the diaphragm. This variety may also affect the intestines and mesentery, causing matting together of the former and the formation of adhesions and fibrous bands.

The chronic diffuse adhesive variety is usually the result of an acute general peritonitis. The peritoneum is thickened and the layers are indistinguishable, while the intestines are tightly matted together.

Proliferative peritonitis is most often due to chronic alcoholism. It consists principally in the production of connective tissue, which causes a great thickening of the peritoneum. Adhesions are not usually present. The omentum is often rolled up into a hard mass, which lies transversely across the abdominal cavity. This form of peritonitis may develop without fibrin, serum, or pus, or these may be present in small amounts.

According to Cornil and Ranvier, both circumscribed and diffuse hæmorrhagic peritonitis may occur, though seldom, in hypertrophic cirrhosis, articular rheumatism, tuberculosis, and Bright's disease. The inflammation causes the development of successive layers of connective tissue containing large numbers of wide vessels with thin walls, from which hæmorrhages occur. The circumscribed form is the more common.

Treatment.—All food capable of inducing the production of gas should be forbidden and constipation be relieved by enemata or gentle laxatives. Iron, arsenic, quinine, and other tonics, as

well as the iodides, may prove of value.

Surgical intervention, however, is of most service, and when ascites is present, if repeated tapplings fail to stop the accumulation of fluid, operative intervention is often indicated.

Tuberculous Peritonitis.

Symptoms.—This disease may, in some cases, be entirely latent, and be only recognized by the surgeon during an operation for some other condition.

In other cases, however, it is ushered in by fever; rapid, small pulse; more or less acute pain in the abdomen; and continuous diarrhoea, or diarrhoea alternating with constipation. Rapid loss of flesh and strength follows, and ascites is frequently present.

When the acute stage is absent the onset may be slow, with low fever, tympanites and tenderness of the abdomen gradually developing. Pigmentation of the skin is often present.

Ascites is a very frequent symptom of tuberculous peritonitis and, according to Senn, the amount of fluid may vary from a teacupful in the circumscribed to four or six gallons in the diffuse form. Distinct fluctuation is obtained in the latter variety, while the former may simulate small cystic tumors.

In the cases without effusion the adhesions are apt to result in various gastro-intestinal disturbances, even causing intestinal obstruction at times. Symptoms may, however, be entirely latent.

Conclusions based on 54 cases of tubercular peritonitis: Tuberculous inflammation of the peritoneum in children is much more frequent than is generally supposed. It may be asserted that almost all cases of so-called idiopathic ascites are nothing else than tuberculous inflammation of the peritoneum. The exudate in this affection is frequently absorbed under a general tonic treatment, and complete recovery ensues. In

the majority of cases it develops stealthily; the family, at first, notices only that the child is becoming emaciated and anæmic without any apparent cause. The diagnosis is considerably facilitated if a concurrent exudative pleuritis is found. The thickening of the peritoneum (detected by grasping a fold of the abdominal wall) is one of the most valuable signs of tuberculous inflammation of the peritoneum. In tubercular peritonitis the fluid in the abdominal cavity is rich in albumin and of high specific gravity. Frequently the entire peritoneum may be found covered with recent tubercular masses, and yet the subjective symptoms may be insignificant. The greatest difficulties in diagnosis are encountered in cases of chronic ascites dependent on tubercular pericarditis (a very rare affection). In rare cases the onset of the disease is accompanied by acute symptoms. A. A. Kisel (Vratch, May 26, 1901).

Diagnosis.—In the acute cases the symptoms of enteritis or hernia may be closely simulated, while in those of slow onset the differential diagnosis from typhoid fever is not always easy.

When ascites is present it must be separated from the same condition due to hepatic cirrhosis, chronic simple peritonitis, and cancerous peritonitis. The latter usually occurs late in life, and, although the omental tumor, ascites, and abdominal pain may be present in both diseases, there is generally absence of the tubercular history, with the presence of a gradually growing mass, and the peculiar cachectic appearance observed in cancer.

When the effusion is circumscribed the diagnosis must be made between that and ovarian cysts, pregnancy, hydrosalpinx or pyosalpinx, pelvic abscess, hydro-nephrosis or pyonephrosis, pancreatic cyst, or enlarged gall-bladder. In differentiating the tuberculous tumor from an ovarian cyst, which is the most frequent source of error, the fever, intes-

tinal disturbance, history of the patient, and presence of tuberculous lesions in other parts of the body would point toward the former. In all the pelvic diseases a careful vaginal and rectal examination—under ether, if need be—will soon make clear the diagnosis. The tuberculin test may also be of value.

Etiology.—Most of the cases are due to extension of the disease from some adjacent organ. Out of 2230 post-mortems by König in Göttingen there were 107 cases of tubercular peritonitis. Of these, 89 were males and 18 females. In 99 tuberculosis of the lungs co-existed; 60 had more or less severe pleural complications; 80 had ulceration of the intestines; 44 had affection of the mesenteric glands; 38 had tubercle of the kidneys; 40 had the spleen affected; 4 of the 18 females had tuberculosis of the tubes and ovaries. Osler states that in his own series of 21 cases 15 were males, but that in the collected statistics the cases are found to be twice as numerous in females as in males, owing to the fact that the recent laparotomies performed in this disease have been chiefly in women. It may occur at all ages, but is most common between 20 and 40.

Pathology.—The peritonitis accompanying miliary tuberculosis shows the peritoneum studded with small, gray, translucent tubercles. In the more frequent form of tuberculous peritonitis the peritoneum becomes thickened, the intestines are matted together, and adhesions are formed which often capsule the exudate, resulting in small tumors. The omentum may be thickened and contracted into a hard mass. When fluid is present it is usually serous or fibrinous, although it may become hæmorrhagic or purulent.

Tuberculous peritonitis is divisible into four forms: 1. Adhesive: the commonest

and usually most easily detected form. 2. Suppurative. 3. Tympanitic. The onset may be extremely sudden, suggesting that a softened tuberculous lymphatic gland has ruptured into the peritoneum. Vomiting and symptoms of definite obstruction may accompany the onset; sometimes severe gastro-enteritis may be met with at the same time. More often the onset is gradual. 4. The ascitic form, often associated with cirrhosis of the liver. Gee (St. Bartholomew's Hospital Journal, May, 1900).

Treatment.—The medical treatment, which is seldom satisfactory, consists in maintaining the general health of the patient by means of rest, good hygienic surroundings, easily digested and nourishing food, and tonics. The symptoms are to be treated as they arise.

Laparotomy seems to offer the best hopes for amelioration and in some cases for cure. An examination of the records of three hundred cases by Treves (Brit. Med. Jour., Oct. 31, '96) shows that excellent results have been obtained in tuberculous peritonitis of almost all grades, and that good prospects of recovery may be expected in over 60 per cent. of instances. The highest percentage of cures has been attained when the abdomen has been neither flushed nor drained, but when the exudation has been merely evacuated and the parietal wound closed. Great care should be taken to avoid injuring the membrane; indeed, it is much better to allow a few ounces of a harmless effusion to remain than to remove it by reckless flushing and sponging.

Attention called to the remarkable results of laparotomy in tubercular peritonitis of children. A few physicians will advise only the more conservative methods of aspirating to remove the fluid, a tight abdominal bandage, and irrigation with salt solution, etc. From his personal experience, the writer had no results from

aspirating. The only reliable statistics are based on the condition of the case some time after operation. In 45 cases, 25 were treated without operation, by the use of ointments and baths. Of these 25 cases, 9 died—36 per cent. In the other 20 cases, with operation, 2 died—10 per cent. With these results laparotomy would seem to be the best method. By following the cases for a year the following developments were obtained in 23 of the cases: 10 without operation, 13 with laparotomy. In the non-operative cases 8 died; following the laparotomies only 3 died; while the rest remained entirely well. The cases are classified under the following forms: (1) Exudative—not operated 5, died 3, lived 2; operated 6, lived 6. (2) Adhesions and infiltration—not operated 4, all died; operated 4, died 1, lived 3. (3) Ulcerative peritonitis, with pus—not operated 1, died 1; operated 3, died 2, lived 1. These results prove that the prognosis is best in the exudative form, and spontaneous recovery, while possible, is rare. In the second form the prognosis is worse, while in the third, in spite of its extreme severity, entire and lasting recovery may follow operation. (Schramm (Allg. Wien. med. Zeit., Apr. 14, 1903).

Others have used sterilized air with considerable success, this treatment being based upon the fact that the introduction of air during laparotomy in such cases was the main factor in the excellent results observed.

The writer obtained the excellent results which he has reported in tubercular peritonitis by prolonged residence at the seashore. Not only has this obstinate form of tuberculosis yielded, but also other forms of surgical tuberculosis. Out of 100 patients, 61 were discharged cured. Of 98 patients sent from the marine hospitals, Banyuls-sur-Mer and Saint-Trojan, 70 remained well for periods varying from four to ten years. For a cure of local tuberculosis it is important that the patient should come under treatment at the earliest possible

moment, and that residence at the seashore should be sufficiently long to have all of the symptoms disappear. Chas. Leroux (*Arch. de Méd. des Enfants*, Tome vi, No. 6, p. 356, 1903).

Three cases in which tuberculous peritonitis were treated with success by means of subcutaneous injections of iodine (Durante's method). One gramme of the Durante's solution was given daily in the region of the abdomen. It consists of 1 part of metallic iodine, 10 parts of potassium iodide, 20 parts of guaiacol, as an anæsthetic, and 80 parts of sterilized glycerine. In one case, after eighty injections the fluid in the abdomen completely disappeared and there were no symptoms on the part of the intestines. Palombari (*Gazz. degli Osped. e delle Clin.*, Sept. 27, 1903).

Nineteen cases of tuberculous peritonitis treated purely by medical methods with very good results. The treatment consisted in forced feeding, rest and iodides, both locally and internally. Tincture of iodine or an ointment of potassium iodide was applied locally. The author emphasizes the fact that surgical treatment is indicated only in the simple ascitic form of tuberculous peritonitis. Of the 19 cases reported, 15 recovered. Of 14 cases reported in detail, 8 were ascitic and 4 both ascitic and fibrocaseous, while in 2 there was no fluid, but only dry and cheesy tubercles. A milk diet was used in all the cases at first, and intestinal antiseptics were employed, but the chief reliance was placed on the iodides. Miserochi (*Gazz. degli Osped. e delle Clin.*, May 20, 1904).

Any tuberculous foci, as diseased tubes, also enlarged lymphatic glands, should be removed.

Two hundred and five cases of peritoneal tuberculosis which were operated upon collected. Of the 205 cases, 15 (or 7.5 per cent.) died; only a few of these from peritonitis or sepsis, the most from collapse after long operations. Among 186 patients, of whom the sex was given, 11.3 per cent. were men. In women the genital organs were most commonly the

avenues of infection. The number of fatal cases among men was greater than among women. The best prognosis is to be given in capsulated cases and in those with much exudate. The most important factor in resorption is that the serosa should be intact. Lindner (*Deut. Zeit. f. Chir.*, B. 24, p. 448, '92).

Of 118 cases of tuberculous peritonitis of children treated by laparotomy, personally collected, 82 were successful, 36 fatal, either by generalization of the disease or as a result of the operation. Phocas (*La Méd. Mod.*, Dec. 3, '92).

Only the ulcerous form of tubercular peritonitis is incapable of spontaneous recovery. Of 308 cases of all forms treated by operation, 140 were of the ascitic type, and of these 101 were cured, 3 died, 2 were improved, 6 not improved; of 26 cases of the fibrous type, 21 were cured and 5 died; of 22 cases of the ulcerous type, 13 recovered and 9 died; of 41 cases of tuberculous peritonitis secondary to tuberculosis of the pelvic organs, 27 were cured and 14 died. The number of deaths includes those due to operation and those due to the disease. The mortality of operation is put down as 2½ per cent.; 33.4 per cent. of the "cured" cases are stated to have been complete recoveries.

In regard to the indications for operation in the ascitic type, the very acute cases, or those forming part of acute general miliary tuberculosis, are not to be operated upon. The other varieties, whether the dropsy is encysted or not, are amenable to laparotomy. Irrigation, medication of the peritoneum, and drainage have shown no better results than simple incision; further, sinuses have sometimes followed the use of drainage. Relapse occasionally occurs.

The fibrous form least often calls for interference, as it is the form which recovers spontaneously or by medical measures. If, however, the general condition of the patient is deteriorating, operation may be required. Incision and irrigation have given the best results. The ulcerous form, where there is little or no fluid or the fluid is encysted in many small loculi, is almost beyond the reach of operation; where, however, the

fluid is not confined to one or to several large pockets, incision and drainage are of benefit. Treves (*Annals of Surg.*, May, '94).

It is the imperative duty of the surgeon to freely evacuate by incision all fluid of a tubercular peritonitis. In all probability additional perfection will be obtained by irrigation with normal salt solution. Where advanced tubercular deposits can be sponged over with camphor-naphthol, it is probable some additional good will accrue. The purulent form of peritonitis is amenable to the same treatment. Cure has frequently followed a second laparotomy when the ascites has reaccumulated, which is the exception. Abbe (*Med. News*, No. 5, '96).

Case of a girl, aged 20, with tuberculous peritonitis, upon whom laparotomy has been personally performed four times in six months, with the result that for the last four and a half months there has been no sign of recurrence, and the general health has been highly satisfactory. After each operation temporary relief was noticed. Careful microscopical examination of the affected peritoneum was made each time, and as a result of this it is affirmed that cure takes place in these cases by leucocytic invasion, organization of fresh connective tissue, vascular new formation, and substitution of tuberculous tissue by inflammatory neoformations. Washing out the peritoneal cavity does not act in virtue of any particular antiseptic or antituberculous property of the solution, but mechanically by setting up a certain amount of inflammation, and the washing assists this partly through the disturbance which the sponging out of the fluid necessitates. D'Urso (*Il Policlin.*, June 10, '96).

Following conclusions drawn in regard to laparotomy in tuberculous peritonitis:

1. The danger of the operation is very slight (3 per cent.).
2. Infection is less likely to occur than in a healthy peritoneum.
3. Tubercular infection of the wound itself is never observed.
4. It is unnecessary to use any antiseptic for flushing the peritoneum, or to insert a

- drainage-tube.
5. The operation, even if unsuccessful, does not aggravate the condition of the patient.
6. Tubercular lesions in the lungs are rather an indication for operation than otherwise, since the general condition of the patient is usually so much improved by this procedure. Parker Syms (*Med. Rec.*, Apr., '98).

Leaving aside miliary or granular peritonitis peculiar to children, where surgical treatment is not to be thought of, there are three chief varieties of tubercular peritonitis which are to be treated by laparotomy.

1. Ascitic—serous effusion into peritoneum, sometimes sero-purulent, or even sanguinolent. Here the peritoneum is injected, deprived of its gloss, and sometimes has fibrinous deposits.

2. Ulcerous, or fibrocaseous. This has an abundant production of false membranes, forming considerable thickenings, even tumefactions of the peritoneum. Numerous adhesions exist both between the opposing parts of the peritoneum and between these and the viscera. Here and there are accumulations of sero-purulent liquid, and occasionally softened cheesy masses. In this kind perforations are frequent, and stercoraceous abscesses occur.

3. Fibrinous, or dry, peritonitis. No liquids, but adhesive inflammatory exudates whose fibrinous transformation tends to cause regression of the tubercles around which they form.

In addition to these general forms there are circumscribed forms which also admit of successful handling in this way. Duplaz (*Le Bull. Méd.*, July 6, '98).

As result of invasion of tubercle, the peritoneum becomes intensely hyperæmic, and may sometimes, by its strong reaction, check the spread of infection. More frequently, however, the peritoneal reaction is insufficient. The entire organism becomes progressively enfeebled, and death results.

If laparotomy be performed, and especially if a large incision be made, the peritoneal reaction already existing is rendered much more intense. This

hyperæmia continues for many weeks, and terminates generally by checking the tubercular invasion. The exposure to air, chemical reagents, and the evacuation of the fluid, together with the approximation of the peritoneal surfaces, are only of secondary importance. M. Nassauer (Münch. med. Woch., No. 16, '98).

The invasion of the apices of the lungs, serous pleurisy with slight effusion, is not an absolute contra-indication, since these lesions, if commencing and limited, may be cured by the operation. On the contrary, acute miliary tuberculosis, extensive lesions of the lungs, tuberculosis of the liver, the kidney, or the intestines, tuberculosis in the genitalia being excepted, are contra-indications to the surgical intervention.

The reproduction of the ascites after treatment by laparotomy is treated, according to the circumstances, by a new laparotomy or by repeated punctures, abdominal massage, iodide, collodion, etc., which sometimes succeed in producing a definite cure. Delangree (Ann. de la Soc. Belge de Chir., No. 9, '99).

Study of 227 cases collected in which incision into the peritoneal cavity was performed for the cure of tuberculous disease. The incision is the curative factor. Permanent cure follows opening of the peritoneum without either antiseptics, washing out the peritoneal cavity, or removal of tuberculous nodules, etc. Report of fifteen unpublished cases in which simple opening of the peritoneum at the Breslau clinic resulted in cure. Ebstein (Thesis, Breslau, '99).

Analysis of 500 cases, out of which 68 per cent. were of the exudative variety, 27 per cent. of the fibro-adhesive, and 4 per cent. of the purulent. Two-thirds of the first variety were observed at least three years, and in 23 per cent. of these the ascitic fluid accumulated rapidly after operation. In the 344 cases of the exudative variety the primary mortality was 22.6 per cent.; 23 per cent. were well three or more years after operation. Operations were most unfavorable in the suppurative variety, over 50 per cent. succumbing at once or a short time after. While abdominal section has a favor-

able influence upon tuberculosis of the peritoneum, it is not the only and certain means of effecting a cure. As the most successful results occur, according to Galti and Hildebrandt, in cases in which retrograde processes have already begun in the tubercular nodules when the abdomen is opened, cases for operation should be carefully selected. The best results are to be expected when no complications are present in cases of simple ascites. Wunderlich (Archiv f. Gynäk., B. 59, H. 1, '99).

How great an improvement has taken place in the treatment of cases of tuberculous peritonitis may be judged from the fact that statistics show that now over 50 per cent. of these cases recover. In the acute cases he has had excellent results from the rubbing in of iodoform ointment on the abdominal surface.

There is this distinction between medical and surgical treatment, viz.: that *medical* treatment cannot be begun too early, whereas *surgical* treatment may be. Watson Cheyne points out that it is an error to operate too soon, for if operation is done too early the disease is apt to return. He recommends that medical treatment should be given a reasonable time, which he estimates as from four to six weeks in the acute cases, and from four to six months in the chronic ones. The operation he recommends is a very simple one: in cases with effusion without adhesions, the abdomen should be opened in the middle line below the umbilicus and the fluid allowed to run out, aided by turning the patient on his side, and, "perhaps, removing some of it by means of sponges," then stitching up the wound again. He does not recommend washing out the peritoneal cavity unless the effusion is purulent; in that case he advises the use of salt solution for this purpose, and then introducing a little iodoform-and-glycerin emulsion into the cavity before closing it. He also urges that medical measures should be superadded to the surgical ones as soon as possible. Ebstein also supports Watson Cheyne's opinion that "simple opening of the peritoneum" is best "without antiseptics and without washing out or drainage."

As to the cases in which operation should be performed, authorities differ. Watson Cheyne says: "All, even the gravest forms, show some good results, and there is *no* form in which we can say that laparotomy is absolutely useless." He states that he has "had success in the dry form as well as in the ascitic." He considers that the most favorable cases are those with *localized* ascites, and the next those with *diffused* ascites. Then comes the fibro-adhesive form, when moderate in extent and no ascites. In cases where the abdomen contains large caseating masses successes are not frequent, and he maintains that they do sometimes occur. He does not consider the co-existence of early phthisis a counter-indication, but with advanced phthisis the results are not good. He is doubtful if laparotomy does any good in cases with intestinal ulceration. I. Burney Yeo (Lancet, Mar. 16, 1901).

Surgery has been altogether too aggressive in the treatment of the ascitic forms of this disease. Until it became fashionable a few years ago to attempt to remove the infected area, all these cases went on to recoveries. After this advanced technique was introduced all of them went on to death. Plea for a return to the ancient, but honorable, technique of simple incision and drainage without manipulation or laceration of the infected area. A. J. Ochsner (Medical News, May 16, 1903).

A series of 33 cases of tuberculous peritonitis showed that in the serous form the prognosis is good, provided that there are no marked visceral complications. The absence of fever and weak heart action usually indicates that such complications are not present. In most cases in which there is no effusion abdominal section is dangerous, or is rarely followed by good results, excluding primary tuberculosis of the tubes. Thoenes (Zentralbl. f. Gynäk., No. 17, 1903).

Tumors of the Peritoneum. — Carcinoma, sarcoma, hydatid cysts, dermoid cysts, and chyle-cysts are among the principal forms of tumor found arising

from the peritoneum. These tumors usually develop in the mesentery or the omentum. The dermoid cysts spring from the ovary, but may become separated from it and become implanted on omentum or mesentery. The chyle-cyst arises in the mesentery as a result of occlusion of one or more lacteal ducts.

CANCER OF THE PERITONEUM.—*Symptoms.*—In primary cancer the symptoms during the early part of the disease may be entirely latent or may consist of an uncomfortable feeling and some pain in the abdomen. As the peritoneum becomes more involved, ascites, emaciation, loss of strength, and the characteristic cachexia appear.

These same symptoms are present in secondary cancer, but are more readily recognized as cancerous on account of the disturbances caused by the primary disease.

In both forms the large effusion may result in difficulty in respiration, and rupture of the vessels in the cancer may be followed by severe hæmorrhage, with its accompanying symptoms. On account of the amount of the ascitic fluid, tumor-masses are not easily palpated until after paracentesis.

Diagnosis.—In the primary form, especially when a large quantity of ascitic fluid is present, it is sometimes almost impossible to establish a diagnosis from tubercular peritonitis with effusion. In secondary cancer the history of malignant disease in one of the organs makes the diagnosis easy. After tapping, or when tumors can be palpated without resorting to this operation, differential diagnosis must be made between this disease and chronic tuberculous and proliferative peritonitis.

In all three diseases the omental tumor is likely to be present, but in cancer enlargement of the inguinal glands is often

noted; nodular tuberculous peritonitis occurs usually in children, concerning whom a tuberculous history is often obtainable. Cases of proliferative peritonitis generally give a history of chronic alcoholism.

Echinococcic cysts may be distinguished by the fremitus, the history, the lack of cancerous cachexia, and examination of the fluid. In colloid cancer, although the abdomen may be greatly enlarged, the mass does not fluctuate.

Retroperitoneal tumors are often very difficult to differentiate, but they are generally immovable, while cancerous tumors of the mesentery or omentum are movable and follow the respiratory movements.

Etiology.—Cancer of the peritoneum is usually secondary to cancer of the stomach, liver, uterus, or some other organ. It is more common in women than in men, and is a disease of middle and late life.

Prognosis.—Cancer of the peritoneum always results in death in from a few weeks to several months.

Treatment.—This is only palliative. Pain may be relieved by the opium preparations, and constipation by mild laxatives. If the effusion is so large as to cause distressing symptoms, paracentesis is to be resorted to, care being taken not to enter an adherent intestine.

SARCOMA.—Sarcoma of the mesentery is of rapid growth and almost always results fatally. Ascites is usually present in these cases. These growths are seldom removed successfully by operation, because they are attacked too late. There is rapid involvement of surrounding structures, making complete removal impossible. A fatal termination is inevitable.

HYDATID CYSTS of the peritoneum are found in the mesentery, the omentum,

and broad ligaments, and are secondary to primary growths of visceral organs: the liver, the spleen, and the kidneys. They cause great pain by traction. The diagnosis is made by a peculiar fremitus; but this sign cannot always be obtained, so that the true condition is seldom learned until after exploratory incision. The only treatment is *cœliotomy*. All cysts should be removed when possible or else incised and evacuated, followed by thorough washing and drainage. These cases are often successfully dealt with by operation, the only dangers being those common to the average *cœliotomy*.

Hydatid disease is very prevalent in the Argentine Republic, owing to the large number of neglected and ill-fed dogs kept on the farms, and the cattle industry. Of 952 cases treated in Buenos Ayres since 1877, the liver was the seat of the disease in 641, the lung in 54, the spleen in 30, the kidney in 18, and the brain in 15. A very fatal form, the "peritoneal hydatidosis," in which the peritoneum is studded with thousands of small vesicles, is described. The mortality from operation reached 12 per cent., the death-rate being highest in cases of multiple cysts of the abdominal organs and the brain. Marsupialization and drainage are deemed much more certain than the method of extracting the mother-membrane. Vegas and Cranwell (*Revue de Chir.*, Apr., 1901).

Ascites.

Definition.—Accumulation of fluid in the peritoneal cavity.

Symptoms.—When the abdomen becomes greatly distended with fluid the breathing is interfered with; the heart and liver are pushed upward, causing disturbances of the circulation. Gastrointestinal symptoms—such as vomiting, constipation, and distension of the intestines with gas—are common; frequent micturition is also noted, the urine being frequently albuminous.

The abdomen presents a rounded appearance, and may sometimes show the *linæ albicantes* and enlarged veins. Fluctuation may be obtained by tapping with the finger-tips of one hand and receiving the impression with the palm of the other, which is placed on the opposite side of the abdomen. Percussion yields dullness, which is found movable as the patient changes his position. If the intestines are much distended with gas, tympanic resonance will be obtained.

Diagnosis.—The diagnosis of ascites is usually not difficult, especially when the accumulation of fluid is large. The abdomen is distended and the skin smooth and shining. When the patient is lying on the back the greatest bulging is in the flanks when there is dullness on percussion over the fluid. The small intestines floating on the top of the fluid give a tympanitic note on percussion in the umbilical region. These signs necessarily change when the patient assumes different positions. In the erect posture the dullness may reach the level of the umbilicus in front and in the axillary lines. When the patient lies on one or other side the tympanitic note is found in the opposite flank.

Ascites is to be distinguished from ovarian and other cysts, pregnancy, and distended bladder. Bearing these possibilities in mind, we will seldom make mistakes. In ovarian cyst there is seldom bulging in the flanks where we have a tympanitic note on percussion instead of dullness. There is dullness on percussion at and around the umbilicus. In other words, the tumor displaces the intestines and seems to rest upon them, whereas in ascites the intestines float on the surface of the fluid. In ascites vaginal examination often shows that the uterus is movable.

In diagnosing ascites from chronic peritonitis, a previous history of disease of the liver, heart, or kidneys; symmetrical enlargement of the abdomen; absence of hard masses upon palpation, and little or no pain would favor the former.

As a result of a study of 168 cases collected from literature and 9 personally observed, the writer states that a characteristic of essential dropsy is the appearance of œdema in one or more parts of the body without albuminuria or sedimentary evidence of organic disease of the kidneys, and without clinical or post-mortem evidence of organic disease of the heart or kidneys. It may occur in children of any age, and often in those who, during its presence, are otherwise well. It may be associated with symptoms more or less peculiar to it. It may precede, accompany, or immediately follow some disease other than the organic conditions above mentioned. It may be acute or chronic in its course. A. W. Fairbank (*Amer. Jour. Med. Sci.*, Sept., 1903).

In pregnancy the only sign in common with ascites is enlarged abdomen. Distended bladder with incontinence from retention is sometimes mistaken for ascites. In doubtful cases the patient should always be catheterized.

The appearance and nature of the peritoneal fluid depends upon the cause of its formation. By aspiration we can often determine this cause. Pure ascitic fluid, due to cirrhosis of the liver, is clear and serous. Blood-stained fluid may be due to cancer, tuberculosis, or ruptured extra-uterine pregnancy. The amount and appearance of the bloody fluid are aids in the differential diagnosis.

Chylous fluid caused by disease of the lymphatics is occasionally found free in the abdominal cavity. It is said to be due also to excessive milk diet and to filaria.

Etiology.—Ascites is not always due to disease of the peritoneum. It is often a

symptom of disease of the liver or disturbance of the circulation of the portal veins, by compression or inflammation. It generally accompanies cancerous or tuberculous disease of the peritoneum and malignant disease of the abdominal organs, and is sometimes associated with benign tumors. It is said to be caused by freely movable, large, pedunculated fibroid tumors of the uterus. As a rule, when ascites is associated with tumor we may safely diagnose malignancy. The causes of ascites enumerated have been studied under their respective heads.

Treatment.—The medical treatment consists in administering hydragogic cathartics and diuretics, of which bitartrate of potassium is one of the best. Calomel and digitalis may also afford relief. Tonics should be employed to raise the general health of the patient, and the ingestion of fluids should be restricted.

When the amount of fluid is large, puncture of the abdomen must be resorted to and repeated at varying intervals. According to Fitz, this puncture should be made in the median line midway between the symphysis and navel, or on either side midway between the symphysis and antero-superior spine. A straight trocar $\frac{1}{8}$ inch or less in diameter, previously cleaned by heat, should be used. It should be made evident by previous percussion that a coil of intestine does not lie directly beneath where the patient is to be tapped. Every antiseptic precaution is to be taken before and during the operation. (See CIRRHOSSIS OF THE LIVER, volume ii.)

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PERNIO (CHILBLAIN).—Pernio is an erythematous local inflammation and swelling of the skin due to cold. (See also ERYTHEMA.)

Symptoms.—In the majority of cases there is slight redness, swelling, itching, and burning of the part. These symptoms all become intensified in severe cases, and the inflammation may be so great that vesication and ulceration result.

Chilblains may be followed by a general tumefaction of the regions attacked, which is the result of local asphyxia even more than of chilblains themselves. In the hands and toes this tumefaction gives a peculiar sausage-like aspect to the parts, somewhat like that resulting from acromegaly. Another consequence, still more rare, of chilblains is the production of localized and persistent vascular dilatations, true acquired capillary angiomas, on which there are small papillomata resembling warts.

Etiology and Pathology.—Defective or insufficient alimentation facilitates the development of chilblains; inactivity also assists; cold, aided by defective conditions of circulation and of functions of the economy, is their main cause. It exerts still greater effects when the skin is wet or not properly dried, or when it is suddenly succeeded by heat. Chilblains may often be prevented if the parts which have been exposed to the cold are slowly and progressively warmed. (Thibierge.)

The relation between the lymphatic constitution and a predisposition to chilblains is ascribed by A. E. Wright (Lancet, Jan. 30, '97) to a lymphatic constitution, due, in turn, to a water-logging of the tissues through an excessive transudation of lymph. A slight increase of transudation converts such a condition of the tissues into perfectly definite hæmatomata such as are seen in chilblains. The subjects of malarial cachexia are not infrequently also the subjects of chilblains, which are also of

very frequent occurrence in hæmophilic families.

Treatment.—The obvious indication in a case of chilblains is, according to Wright, to increase the patient's blood-coagulability, and in conformity with these indications patients are to be placed upon a regimen of calcium chloride, after duly cautioning them against lowering their blood-coagulability by the ingestion of sour fruits, alcohol, or excessive quantities of fluid.

A solution of acetate of zinc, one drachm to the pint of water, applied to the foot will, according to G. J. Monroe, give almost instant relief.

Codliver-oil, preparations of iodine, iron iodide, and arsenic are indicated in all cases. M. Brocq (N. Y. Med. Jour., Jan. 30, '97) obtained good results from the association of quinine sulphate and of ergotine (in doses of from $\frac{3}{4}$ grain to 3 grains) with powdered digitalis (from $\frac{1}{5}$ to $\frac{1}{3}$ grain) and the extract of belladonna ($\frac{1}{2}$ grain) in the form of pills, the employment of which was prolonged during the entire winter. Inhalations of oxygen are indicated in subjects in whom the sluggish condition of circulation predisposes them to chilblains. Regular exercise, walking, gymnastics, cold affusions, and general stimulating lotions are also extremely useful prophylactic means in the majority of subjects. The hands should be covered with thick and sufficiently warm gloves, but rough woolen gloves should be avoided. They, like the feet, should be washed in warm water (not in cold) and carefully dried on a towel (never before a fire), and then powdered with starch or talcum in order to remove every trace of dampness. The hands should not be allowed to remain too long in cold or soapy water. Shoes and stockings should be comfortably large; they should be thick enough to

protect the feet against the action of the cold. If sweating accompanies the chilblains, repeated foot-baths must be resorted to. Foot-baths containing small quantities of astringent decoctions of walnut-leaves, of ash-leaves, of eucalyptus-leaves, of oak-bark, etc., of from five to six minutes' duration, constitute a very useful means of preventing frost-bites. When the lesions are due to hyperæmia with little or no infiltration of the skin, zinc-oxide ointment, such as the following, to which has been added a small quantity of carbolic acid or menthol, will suffice to allay the pruritus and cause the rapid disappearance of the lesions:—

R Zinc oxide, 150 grains.
Carbolic acid, 8 grains.
Vaselin,
Lanolin, of each, 225 grains.—M.

If there is active inflammation, the preferable treatment is with an ointment containing lead salts, such as the following:—

R Lead subacetate, 30 grains.
Carbolic acid, 8 grains.
Zinc oxide, 225 grains.
Vaselin,
Lanolin, of each, 300 grains.

When chilblains resist these topical applications, ointments containing silver nitrate, or painting with 50-per-cent. solution of silver nitrate or with the tincture of iodine, often hastens their resolution. If blisters form they should be opened aseptically and covered with a dressing of vaselin and boric acid, or with freshly-prepared carron-oil to which has been added 2 per cent. of carbolic acid. If these blisters have been ruptured, or the chilblains are ulcerated, after bathing the parts with a weak solution of corrosive sublimate they should be covered with a dressing of vaselin and boric acid, or with non-irritating plasters, such as

zinc oxide, simple boric acid, and dermatol plasters, or Vidal's red plaster. If the ulcerations do not disappear they should be touched every two days with a silver-nitrate stick, or with tincture of iodine, and dressed with camphorated brandy, with Van Swieten's solution diluted one-half with water, or with aromatic wine. These dressings should be carefully applied, particularly on the toes and between the fingers, where, according to M. Besnier, it is well to place small tampons of absorbent cotton.

Boeck states that resorcin is efficacious in treatment of chilblains, especially when associated with ichthyol and tannic acid, as follows:—

- ℞ Resorcin, 1 part.
Ichthyol, 1 part.
Tannic acid, 1 part.
Water, 5 parts.

The affected parts are painted with this liquid every evening, the bottle being well shaken before using. When the occupation of the patient is such as to absolutely preclude the use of substances which blacken the hands, recourse may be had to the following preparation, less efficacious than the above, but which gives very good results.

- ℞ Resorcin, 8 parts.
Powdered acacia, 5 parts.
Water, 15 parts.
Talcum, 2 parts.

A layer of this mixture is applied to the affected parts every evening, the bottle being well shaken before using.

The following formula of value in rebellious chilblains:—

- ℞ Solution of lead subacetate,
Tincture of iodine,
Tincture of opium, of each, 5 parts.
Starch, 10 parts.
Glycerin, 140 parts.

Chéron (*Jour. de Méd. de Paris*, Mar. 28, '97).

For treatment of chilblains the electric bath applied in the following manner advised: An induction-coil is used and the wires are attached to 2 metallic plates placed at the two ends of an ordinary earthenware foot-bath filled with warm water. This bath should be used at bed-time for ten or fifteen minutes, whenever the slightest threatening of chilblains is noticed. The current is employed as strong as can be borne without discomfort. The procedure should be repeated for eight or ten consecutive nights. H. Lewis Jones (*Lancet*, Jan. 14, '99).

PERTUSSIS (WHOOPIING-COUGH).

Definition.—An acute infectious disease manifesting itself, at the onset, by catarrhal symptoms confined chiefly to the upper respiratory passages, larynx, and trachea, and of which the cough toward the end of the second week assumes a peculiar convulsive character known as the "whoop."

Symptoms.—After a variable incubation-period of from five to thirteen days, the symptoms of a more or less severe coryza present themselves: a coryza at the onset unable to be distinguished from that due to other diseases. The cough at this period is not characteristic; gradually, however, it assumes a paroxysmal character and is more frequent during the night than is the case with a cough due to ordinary causes. At this stage it is seldom that any adventitious sounds are to be heard in the chest.

Toward the end of the second or during the third week the characteristic cough develops. The child recognizes its oncoming and endeavors to suppress it, or runs to its mother or nurse for support; a series of quickly-repeated short coughs bursts forth and persists until the chest is in a state of extreme expiration; the face becomes congested and cyanotic, and the eyes suffused; then follows the long-drawn inspiration accompanied by

the characteristic "whoop." This may be repeated two or three times. The paroxysm generally ends with the expulsion of a large quantity of clear, thick, tenacious mucus from the upper part of the throat. Vomiting, with complete unloading of the stomach, frequently takes place at the same time. In delicate children, and especially in infants, these paroxysms produce great exhaustion, and the little patient falls back with livid face and pulse almost uncountable; the great strain may also induce tenderness of the respiratory muscles.

The frequency with which these paroxysms occur varies much according to the period in the disease and the severity of the attack. In mild cases, eight or ten, in severe cases twenty or thirty, may occur during the twenty-four hours. Their severity is also variable. Both the frequency and severity of the spasms are greatest during the first two weeks of the spasmodic stage, after which they gradually lessen. In some undoubted instances of the disease the characteristic whoop is quite absent. The disease generally runs a longer and more severe course during the late autumn and winter months than during the spring and summer. Impure air, cool draughts of air, and the recumbent posture are apt to increase the frequency and severity of the spasms. The total duration of the disease varies from two or three weeks to eight or ten. The presence of adenoid vegetations in the naso-pharynx adds to the severity and duration of an attack.

Pertussis does, on rare occasions, attack persons of adult age; in such the spasms are not so severe, the whoop is seldom characteristic, and complications are infrequent.

Diagnosis.—During the early catarrhal stage it is difficult, except in those cases in which we know there has been a direct

exposure, to distinguish between pertussis and a catarrhal condition arising from other causes. Toward the close of the catarrhal stage, the spasmodic character of the cough, its frequency and severity during the night, the suffusion of the eyes, and puffiness of the lower lids, are all suggestive symptoms, but not absolutely diagnostic. Slight ulceration of the frænum linguæ due to the violence of the cough frequently occurs in young infants in whom the incisor teeth have been cut.

After the second week the cough generally becomes characteristic and is easily recognized by the attendant. A paroxysmal cough closely resembling that of whooping-cough may be induced by enlargement of the bronchial glands. In early infancy laryngeal spasm producing stridor closely resembling the whoop of pertussis may be due to a catarrhal laryngitis.

Blood examined in 55 cases of whooping-cough, and constant leucocytosis, sometimes considerable in amount, found. In 32 of the cases the leucocytes numbered more than 20,000 in the cubic millimetre. The number was highest in the third and fourth weeks of the disease, when the fits of coughing were at their worst. This corroborates the view that whooping-cough is a general, and not a local, disease. Frohlich (*Jahrbuch f. Kinderh.*, vol. xlv, No. 1, p. 53, '97).

Hacking cough regarded as true pathognomonic phenomenon of the entrance into the body of the toxic agent of whooping-cough. The longer the period of incubation (*i.e.*, the greater the resistance of the system), the greater the infection and the severer and more prolonged will be the sickness; while the shorter the incubation, the milder the disease and the more brief the period of its duration. Illoway (*Pediatrics*, Jan. 15, '99).

There seems to be good ground for the opinion that an increased percentage of lymphocytes, at least equaling or ex-

ceeding that of the polymorphonuclear neutrophilic cells, is a valuable diagnostic aid before the characteristic symptoms of the disease make the diagnosis easy. But like the doctrine of polymorphonuclear leucocytosis in general, the figures are more convincing in the mass than when considered individually. Alfred Wanstall (*Amer. Medicine*, Jan. 10, 1903).

Etiology.—The clinical history of the disease points strongly to the existence of a specific organism to which the catarrhal and nervous symptoms may be more or less directly attributed; but, so far, pathologists have not determined with certainty the exact micro-organism. Afanassiew in 1887 announced that he had found a characteristic bacillus in the sputum of children suffering from this disease. This discovery was confirmed by a few observers, and for a time his bacillus was regarded as the exciting organism; since then, however, doubt has been thrown upon his conclusions. In 1896 Kurloff described a ciliated protozoön of variable size which he considered to be the specific organism. A year later Koplik described a slender bacillus somewhat resembling the bacillus of influenza. In December of the same year Czaplewski and Hensel described a short bacterium, somewhat resembling a diplococcus, which they regarded as the same organism described by Koplik, but they are not certain as to its identity with that of Afanassiew. Still later, Behla comes to the same conclusion as Kurloff, that the specific micro-organism belongs to the protozoa, and is not of a bacterial nature.

Thus it appears that several micro-organisms have been found with sufficient frequency in the sputum of children suffering from pertussis to be regarded as the exciting cause, but at the present no one germ is universally recognized as such. The contagium is thrown off from

the respiratory tract, chiefly in the sputum; the disease appears to be readily communicated through the air even for a considerable distance, and appears to be specially contagious during the early catarrhal stage.

When the sputum is examined during the convulsive stage there is found constantly present a very minute bacterium. It is seen sometimes in the epithelial cells. It grows on most of the ordinary media; best, however, in hydrocele fluid. It is both anaërobic and aërobic. It is a minute, thin, short bacillus; it stains with the ordinary aniline dyes; and is not decolorized by Gram's method. It is somewhat toxic to white mice, but produces no symptoms of whooping-cough in them. Koplik (*Johns Hopkins Hosp. Bull.*, Apr., '98).

In two cases diagnosis was made by examination when there was clinical uncertainty. Czaplewsky examined specimens, and agreed that the microbe was exactly the same as that found by him. Thus, Czaplewsky and Hensel's observations are independently confirmed. Zusch (*Münch. med. Woch.*, June 7, '98).

Study of 8 cases from the standpoint of their pathology and bacteriology. In all the organisms first described by Czaplewski as polybacteria was isolated. The writer concludes that it is an infectious catarrh of the mucous membrane of the respiratory tract and especially of the trachea; the characteristic organisms are to be found in the bronchial secretions and the nervous membrane; their arrangement is characteristic. Desquamative catarrh is very frequent. In inflammations of the lungs, moderate quantities of the bacteria are to be found within the bronchopneumonic foci. The production of the cough paroxysms is due to the position of the colonies in the typical cough situations. The paroxysms are to be looked upon as curative processes, as with the sputum secreted, numerous bacteria are thrown off. The secretion becomes viscid during the course of the disease, probably because of the influence of pus organisms, which give rise to an increase of chemotaxis of leucocytes. After all the

colonies of bacteria are thrown off, complete recovery follows. G. Arnheim (Archiv. f. path. Anatomie, etc., cl. xxiv, p. 530, 1903).

Like other infectious diseases whooping-cough generally occurs in epidemics, which are more frequently met with during the spring and autumn months, and in a peculiar way are frequently associated with epidemics of measles. The majority of cases occur in children under the age of four years; it is seldom met with in children over twelve years; in early infancy it is peculiarly severe and fatal.

Observations in epidemics including 1163 cases of whooping-cough showed that strong children seemed more disposed than weak ones. Five children had second attacks, and 37 who were exposed to the disease at one time without taking it contracted it at a subsequent exposure. In the sputa of 147 patients examined Ritter's diplococcus *tussis convulsivæ* was found in every instance. Ritter (Arch. f. Kinderh., B. 20, H. 3 and 4, '96).

Pathology.—In simple uncomplicated cases, beyond a catarrhal inflammation of the larynx and trachea little is to be noted. In severe cases the inflammation may extend to the smaller bronchi. In fatal cases the tracheal and bronchial glands are found enlarged; more or less extensive catarrhal pneumonia is generally present; frequently we find collapse of lung with associated emphysema.

Complications and Sequelæ.—In every case of whooping-cough more or less tracheitis is present, which, under imperfect hygienic conditions or undue exposure, readily becomes converted into a bronchitis, adding to the violence of the symptoms. It becomes still more serious if a broncho-pneumonia develops: a condition indicated by sudden rise of temperature and increased dyspnoea. This complication adds greatly to the fatality of the disease. Some emphysema of the

lung is probably developed in every serious case; a few instances have been noted where emphysema of the cellular tissue of the mediastinum has occurred: a condition which may go on to general subcutaneous emphysema and death. The digestive system is in every case apt to be more or less deranged; vomiting in some cases is a troublesome complication, and may interfere with necessary nutrition. A catarrhal condition of the intestines producing diarrhoea is liable to occur in infants during the summer months.

In all children an attack of pertussis appears to induce an increased irritability of the spinal and cerebral centres. Convulsions are liable to occur, due in some instances to merely temporary causes; in others to serious cerebral lesions such as intracranial hæmorrhage or thrombosis, and followed by more or less extensive paralysis, and sometimes by disturbances of sight and hearing. Hæmorrhage due to mechanical causes is not infrequent; epistaxis occurs frequently; subconjunctival hæmorrhage is more rare; intracranial hæmorrhage is generally meningeal, intracerebral being distinctly less frequent.

Among the more important sequelæ of the disease are various chronic pulmonary affections: emphysema, chronic bronchitis, asthma, atelectasis, and chronic interstitial pneumonia. It is to be remembered also that after an attack of whooping-cough has run its course latent tuberculosis and syphilis may suddenly show indications of activity, the heart may show signs of overstrain, and a condition of undue nervous irritability may persist for many months.

During recent epidemic of whooping-cough occurrence of albuminuria noted in from 10 to 12 per cent. of the cases, and a mortality of 5 to 6 per cent. from acute nephritis. The urine should be frequently examined during this disease.

Stefano Mircoli (*Archivio per le Sci. Med.*, vol. xiv, No. 1, '90).

There is danger of dilatation of the right heart in severe cases of pertussis, a venous stasis first occurring from inflammation of the finer tubes and broncho-pneumonic foci, with overloading of the right heart and the general venous system. Silbermann (*Archiv f. Kinderh.*, B. 18, S. 24, '95).

Prognosis.—Pertussis is more to be dreaded during the winter and early spring months than during summer. The mortality is very high when an attack develops during early infancy, especially in rachitic children, in tubercular children, or in children suffering from adenoid growths in the naso-pharynx. The disease assumes a specially fatal character in foundling-asylums and hospitals where broncho-pneumonia of a severe type is liable to develop. In children over six years of age, serious complications are rare.

Review of fifty-five cases in a period of two years which ended fatally. In the author's five cases, the complications, which only existed in some, were not the primary cause of death. The danger-signal, particularly in young infants, was either a developing stupor or an attack of prostration from which they recovered temporarily to go into a state of increasing stupor and exhaustion until death. In studying the larger series of fatal cases it was found that a catarrhal affection of the mucous membrane is the most probable complication and liable to prove the most fatal by lowering the resistance of the body to the toxic effects of the infection. Average age of the fatal cases was less than one year and duration three weeks. Most of the deaths occurred between April and September. M. H. Hull (*Phila. Med. Jour.*, Feb. 7, 1903).

Treatment.—Treatment of this disease is, by general confession, not satisfactory. While it is among the hopes that may be realized in the future, that we shall be

able to limit the duration and severity of an attack by some antitoxin, at the present no internal medication appears to be able to effect any distinct reduction in what may be regarded as the typical course of the disease. Nevertheless, by careful hygiene and judicious management we may do much to lessen the number and severity of the spasms and prevent complications.

The patient should breathe a pure air not too dry, the temperature of which should not be allowed to vary much from 65° F. Cold draughts, strong winds, and sudden atmospheric changes are to be avoided as liable to increase the catarrhal conditions present and give rise to severe pulmonary complications. During the cold season of the year it is well to confine the patient strictly to two rooms, one of which should be thoroughly aired while the other is occupied. General baths should be omitted; the child should be dressed warmly, and so long as any fever be present it should be kept in bed. Nutrition must be maintained; the diet should be nourishing, but simple and digestible. If vomiting recurs frequently, food must be given in small quantities and at short intervals. Excitement of all kinds is to be avoided.

A threatening paroxysm may be arrested sometimes when in the house by carrying the child to an open window, where it takes several deep inspirations.

The fresh-air treatment is one of the most efficacious, if not the only one, for the management of a case of whooping-cough. The child should pass the entire day out-of-doors, not only in the warm season, but even at all times of the year, provided it be not stormy. It is considered only necessary to prevent the child from running or talking or otherwise provoking an access of coughing. Ullmann (*Jahr. f. Kinderh.*, etc., B. 40, H. 1, '95).

Theoretically, antiseptics should oc-

cupy a prominent place in the treatment of this disease, and many attempts have been made to modify the course of an attack by the topical application of such drugs. Moncorvo claims much benefit from the application of 1- or 2-per-cent. solution of resorcin to the nasal passages, pharynx, and larynx by means of a brush or spray.

Two hundred and ninety children suffering from whooping-cough treated by method introduced by Moncorvo, namely: by applications of a 2- to 3-per-cent. solution of resorcin to the glottis with a fine sponge. The resorcin is to be used without previous cocainization. In the 290 cases treated no other therapeutic measure was employed. Children under two years of age seemed to get well more easily than older ones. After a few applications by the practitioner the treatment is carried out by those in charge of the patient. Roskam (*Ann. de la Soc. Méd.-chir. de Liège*, Feb., '97).

The benefit derived from creasote-vapor is very soon apparent. In many cases a cure is effected in five or six days; in very virulent attacks it may require as many weeks, though this is exceptional. It does not interfere with other methods of treatment. The inhalation appears to be free from danger except where the chest is full of moist sounds, in which case its action should be carefully watched. No fresh case of infection has been seen to arise in a family the healthy members of which have been exposed to the influence of the vapor.

Creasote-vapor can be employed in various ways: with steam by means of a kettle or steam-spray producer; by use of a dry or moist inhaler; by sprinkling on a cloth hung up to dry in a room; by vaporizing over a spirit-lamp, etc. All these means are more or less effectual; but the more continuous the inhalation, the better the result obtained.

The method of treatment personally found most satisfactory is the following: One should commence at once with the

continuous inhalation of creasote by suspending creasote cloths both in the day and night chambers. The density of the vapor employed can easily be regulated by varying the number of cloths. Any accompanying bronchitis should be treated, and the lungs cleared of all moist sounds as much as possible before using any special internal antispasmodic remedies. Antipyrine may be given in suitable doses in all cases where the lungs are fairly clear, provided that the circulation is good. Expectorants may be combined with the antipyrine. The chest and upper part of the spine should be treated by counter-irritation. Good air, warm clothing, light and wholesome food are necessary in all cases. J. E. Godson (*Birmingham Med. Review*, Apr., 1901).

Rabinschek also speaks well of the results obtained from swabbing the pharynx and epiglottis with a solution of mercuric chloride 1 in 1000.

A small tampon of cotton saturated with a 1 to 1000 solution of corrosive sublimate is to be introduced into the back of the mouth and pressed against the lower part of the tongue in such a way that the liquid will bathe the epiglottis and the neighboring mucous membrane.

This method, with which good results have been obtained, was applied in 71 cases of whooping-cough by Rocco Gentile; 35 patients were cured after from three to twelve applications; 13 were considerably ameliorated, and the others interrupted the treatment or complications supervened which did not depend upon the whooping-cough.

One of the greatest benefits to be derived from this treatment is the rapid cessation of the vomiting which contributes so much to weaken the patients, who lend themselves very readily to the treatment and become rapidly accustomed to the introduction of the tampon. Rabinschek (*Bull. Méd. de Paris*, Sept. 13, '97).

Fifty-six cases treated with corrosive sublimate. The following solution was used:—

R̄ Corros. sublimate, 0.50 (gr. viiss).
Sodium chloride (chemically pure),
0.10 (gr. ij).
Distilled water, 1000 (℥xxxij).

Mix and filter.

All accessible parts of the pharynx, epiglottis, tonsils, etc., should be painted with a soft, long-handled brush dipped in this solution, from once to three times daily, according to the severity of the case. The patient should be fed before painting to prevent irritation of the empty stomach by the small quantity of the solution which is swallowed during its application and to obviate the possibility of local disinfection being neutralized by ingestion of food immediately after the painting. Of the 56 cases, ranging from four months to thirty-three years of age, 39 were cured with one daily application and 17 more serious cases with complications received two or three daily applications, supplemented by the remedies commonly used in pertussis. In all a cure was effected in from ten days to one month. C. Calabro (*La Pediatria*, year x, No. 1, 1902).

Nasal insufflations of powders containing quinine have also been strongly recommended. The great objection to such therapeutics is that every application is resisted to the utmost by the child, the mere sight of the brush or spray throwing it into a state of terror. The inhalation of an antiseptic vapor is a much easier method of attaining the same object. Creasote, carbolic acid, cresolin, eucalyptol, or thymol may in solution be readily volatilized by heat and its vapor be diffused through the air and inhaled unconsciously by the little patient. By this method we obtain not only an antiseptic, but an anæsthetic, action on the respiratory passages, and may unquestionably lessen the frequency and severity of the spasm. The best results are obtained when the patient is made to breathe a strongly-charged atmosphere for one or two hours two or three times a day; but caution must be exercised lest

irritation of the kidneys be induced. It is also to be remembered that no antiseptic medication will take the place of pure air.

Naphthalin-vapor employed with brilliant results, causing a rapid diminution in the cough and cure of the disease: 3¾ to 5 drachms of naphthalin should be placed in an earthen dish, and heat applied so that the drug will be slowly vaporized. The fumes are pungent and provoke cough. Use of this agent is contra-indicated in subjects suffering from tuberculosis. Chavernac (*Med. Age*, Aug. 25, '92).

About 20 grains of menthol should be dissolved in 1 ounce of liquid vaselin in an ordinary nasal spray-producer; as soon as a paroxysm begins, or preferably as soon as the patient feels that one is impending, a fine cloud of spray is diffused in front of the face, the spray-producer being held about two feet away; by this means the air in front of the nose and mouth is saturated with the oily particles, and at each inspiration they are drawn into the air-passages; this is quite painless, but occasionally a slight spasm of the glottis occurs. The effect of this inhalation is quickly seen, for the mucus is rapidly expectorated and the paroxysm is soon over, so that convulsions are less frequent and vomiting is rare, with the result that the patient loses his dread of taking food and eats with a better appetite, his general condition being thus kept at a much higher level. S. A. Bontor (*W. London Med. Jour.*, July, '97).

Satisfactory results obtained in treatment of whooping-cough by inhalations of ozone. These inhalations may be given for ten or fifteen minutes twice a day. Caillé reports seven cases and Labbé and Oudin fourteen or fifteen cases in which rapid recovery was obtained with this mode of treatment. M. E. Doumer (*Nord Méd.*, Nov. 1, '97).

Two series of cases of whooping-cough occurred in two different years treated by rectal injections of carbonic-acid gas. Out of 150 patients, 143 were benefited to a very noticeable extent. The 7 cases that were not benefited were of weakling

children in advanced stages of the disease. The carbonic acid was obtained from a mixture of bicarbonate of soda and crystals of tartaric acid. By this method the gas is given off sufficiently slowly so that its administration may be kept up continuously for the necessary length of time. In infants the injections were given for five minutes at a time; in older children for ten minutes. The administration of the carbonic-acid gas is followed by flushing of the skin, especially of the face. In a few of the patients mild diarrhœa developed. It ceased after a day or two, when the injections were discontinued, and they could usually be resumed a day or two later without necessarily causing the diarrhœa.

The success of the injections of carbonic-acid gas was marked only when the nascent gas was employed: that is to say, when the gas was obtained fresh from the chemical reaction of the bicarbonate of soda and the tartaric acid. In a series of 20 cases, in which commercial carbonic-acid gas was used, it seemed to have absolutely no effect on the whooping-cough. N. R. Norton (*Med. News*, Mar. 3, 1900).

Attention called to the claim of Dr. Cenex, of Bohemia, that the vapor of formalin is a specific and preventive of this disease. After citing a number of cases in which the cough was cut short within twenty-four hours, the conclusion is reached that: 1. By the proper inhalation of the vapors of formalin it is possible to destroy the germs of whooping-cough—those existing on the mucous membrane of the respiratory organs and also those in the surroundings of the patients. By this means the disease is cut short and further infection inhibited. 2. In accordance with these experiences it seems advisable that schools, hospitals, churches, and other localities should from time to time be thoroughly disinfected. It is hardly necessary to add that the treatment should be directed or administered only by a medical practitioner. (*Bull. Health Dept. of Chicago*, week ending Feb. 7, 1903).

Internally, sedative and antispasmodic

medicines may be administered with the object of allaying the nervous irritation and checking the spasm. Among the most generally employed are the bromides, belladonna, antipyrine, and chloral-hydrate.

In England essence of amber (*oleum succini*) is a popular remedy in whooping-cough, being rubbed over the vertebral column morning and evening. William Murrell (*Brit. Med. Jour.*, Apr. 1, '93).

Hot poultices as suggested by J. Madison Taylor recommended in pertussis. The poultice is made large enough to cover the posterior surface of the lungs, and on this the child is permitted to lie for one hour without a change. Relief is almost immediate. After an hour it is removed and into the relaxed skin is rubbed some stimulating preparation, as sweet oil and camphor, or turpentine and lard in the proportion of 1 to 15. After this a cotton jacket is applied. One application a day ordinarily suffices, but the poultice should be repeated as indicated. Three ends are achieved by this treatment: 1. It secures rest. 2. It reduces temperature. 3. By relieving congestion pain is lessened. McKee (*Phila. Polyclinic*, Sept. 14, '95).

Phenocoll hydrochlorate valuable in pertussis, 42 cases being successfully treated. Dose varied from 0.07 to 2 grammes daily, given in mucilage or water, in which it is soluble in the proportion of 1 to 7. Good effects were noticeable within twelve hours. Vargas (*Ther. Woch.*, Jan. 5, '96).

Large number of cases of whooping-cough successfully treated by ichthyol. Remedy is administered in the form of a pill, commencing with doses varying from $\frac{3}{4}$ grain to 3 grains, according to the age of the child, and gradually increasing the dose to 15 grains daily. Internal administration of the drug is supplemented by inhalations of a 3-per-cent. solution of ichthyol in glycerin. It is a most effective drug in the treatment of whooping-cough, not only relieving the violence of the paroxysms, but also cutting short the duration of

the disease. Cervesato (*Die Ther. der Gegenwart*, B. 37, '96).

Trional is much superior to belladonna in the treatment of pertussis. In doses of $1\frac{1}{2}$ to 8 grains—according to the age of the child—it produces a quiet and deep sleep only occasionally interrupted by a fit of coughing. In conjunction with the trional, the pharynx is painted with a 1-per-cent. solution of carbolic acid (containing also a small amount of glycerin and alcohol). Busdraghi (*Vratsch*, vol. xix, p. 228, '98).

As a substitute for resorcin in pertussis, asaprol—a soluble derivative of betanaphthol—now used in form of an aqueous solution of the strength of 1 to 100, being applied by means of a brush with a long curved handle to the posterior pharyngeal walls and about the region of the glottis, every two hours in the day. In twenty-six cases ranging in age from 1 month to 9 years, in which the remedy has been applied from the beginning of the attack, the case has been cured before the convulsive stage was reached, and in those cases in which this stage had been reached, recovery followed in from five to ten days. In the beginning it induces attacks, but this is very shortly overcome. Moncorvo (*La Méd. Infant.*, Jan., '98).

Formalin used in the treatment of whooping-cough for the past year. Personal experience shows it is a specific in this affection. Treatment is local and is applied to the throat in not too strong solutions; strength used not stated. H. S. Oliphant (*N. Y. Med. Jour.*, Mar. 4, '99).

Striking results obtained in modifying the course and severity of whooping-cough by the administration of antidiphtheritic serum. In 8 out of 9 cases in which the serum was administered the duration of the paroxysmal stage never surpassed five to ten days; the number of paroxysms rapidly diminished, falling in the course of six or seven days from twenty or thirty in twenty-four hours to three or four, with almost complete disappearance of the repetitions. The violence of the cough also became greatly modified. Vomiting always ceased after

the injections. V. Gilbert (*Revue Méd. de la Suisse Romande*, June 20, '99).

Heroin was tried at the Mount Sinai Dispensary in about 20 cases, but the result had not been good. In a number of cases, for purposes of comparison, antipyrine had been used first, and subsequently heroin, but the latter with less satisfactory results. On resuming the antipyrine the same control of the paroxysm had been noted that had existed before the use of the heroin. In the Good Samaritan Dispensary the best results have been secured from a mixture containing, for a child of two years, 2 grains of antipyrine, 1 minim of tincture of digitalis, and 4 minims of camphorated tincture of opium. Herman (*Pediatrics*, May 1, 1900).

The comparative drug values studied in 752 cases of whooping-cough. As the cases had developed, they had been separated into groups of twenty, and were allowed to cough without treatment until the height of the paroxysmal stage had been reached, which usually required from ten to fourteen days. The ages of the patients treated varied between six weeks and twenty-six years. Three patients only had reached adult life. Five-sixths of the patients had been under four years of age, and one-half under two years of age. It was found that the very young and the very delicate often did not whoop during a severe attack of whooping-cough.

The drug treatment consisted of insufflation, internal administrations, and inhalations. Resorcin and boric acid, combined with bicarbonate of soda, vapocresoline, fluid extract of horse-chestnut leaves, and dilute nitric acid were found valueless. Alum had appeared to be of some service, but had been badly borne by the stomach. Bromoform had proved very unreliable. Cocaine in doses of $\frac{1}{10}$ grain every four hours for a child of two years had been employed in about 25 cases. It had controlled the severity of the paroxysms somewhat, but not sufficiently to warrant its continuance. Great benefit was found from quinine if a large amount could be given. It was difficult to give from 12 to 20 grains of this drug daily, as required. When

quinine could be given in capsules, the number and severity of the paroxysms would be remarkably controlled—sometimes the number being diminished one-third to one-half. Belladonna was used in 60 institution cases, being administered up to the physiological effect; this had required from five to seven days. No influence was observed from this in a single case. True, the cases upon which it had been used were very severe, but they had yielded to other means. Equal parts of bromide of sodium, ammonium, and potassium had been tried in 60 institution cases, using from 12 to 16 grains daily for a child of one year. The results from this treatment were better than those previously mentioned. Antipyrine had been used in 60 institution cases, and it controlled the paroxysms better than any other drug employed, and caused only a trifling depression if administered with ordinary care. The combination of the bromide with antipyrine had been used in 60 cases, with better results than from using either one of these drugs independently. For a child of eight months, $\frac{1}{2}$ grain of antipyrine, and 2 grains of sodium bromide should be given every two hours for six doses, and then its administration should be discontinued for a period of twelve hours. For a child between two and a half and four years of age, 2 grains of antipyrine and 3 or 4 grains of bromide should be given every two hours for twelve hours before being resumed. The steam-spray and fresh air were also useful adjuncts to the drug treatment of whooping-cough. If a remedy is to be of service, its beneficial results may be noticed within twenty-four to forty-eight hours. C. G. Kerley (*Pediatrics*, May 1, 1900).

Heroin is a valuable therapeutic agent which allays cough and eases respiration. It reduces the number of respirations, but increases their force and the volume of inspired air. Aside from its almost specific effect in relieving cough, which has now been fully established, heroin also exerts a distinct influence in allaying dyspnoea.

As to the use of the remedy in the treatment of whooping-cough, Dr. A. Holtkamp reports 5 cases in children

2 to 7 years of age. The drug was given guardedly in doses of $\frac{1}{120}$ to $\frac{1}{130}$ grain, usually three times daily. Under its administration the attacks were diminished both in severity and frequency. Floret describes 3 cases of whooping-cough in children, respectively, 3, 4, and 8 years old. The doses administered varied from $\frac{1}{43}$ to $\frac{1}{30}$ grain. It was always well tolerated, and rendered the attacks much more infrequent and less violent. There was also improvement of the general condition of the patients.

Referring to the statement made by von Herff that the removal of the deposits of mucus on the posterior laryngeal wall aborted the attack, the action of heroin renders this removal easier by allaying spasm and causing the mucus to be more easily expectorated. Thus, in a nutshell is found explained the beneficial action of heroin in whooping-cough. The mucus accumulates on the posterior laryngeal nerve (the nerve of cough), irritating this nerve and producing most intense cough. If these paroxysms can be aborted by the removal of the mucus from this area the patient is rendered less liable to fall a victim to the serious complications of the second stage, and from the antispasmodic and expectorant qualities of heroin are obtained the desired results. H. F. Thompson (*Phila. Med. Jour.*, Jan. 12, 1901).

Bromoform has been very strongly recommended by many writers. It is generally given in alcoholic solution made into an emulsion with gum arabic and syrup, but much caution must be exercised, as the bromoform is liable to be precipitated and thus be present in poisonous amount in the last doses in the bottle. A better plan is to order it to be dropped on a lump of sugar and given in this way to the child. It is not suitable for young infants.

Bromoform is one of the most valuable drugs in pertussis. As it is soluble only in alcohol and glycerin, its administration is sometimes a little difficult, but it

can be prescribed with an emulsion of almond-oil and mucilage flavored with orange. The child may get up to 3 drops if about 6 months old; 8 drops when 2 years old; and when over 5 years of age from 20 to 30. First symptom of intolerance is drowsiness. During the first stage of its administration the attacks of whooping-cough may be slightly more marked, after which they subside. Bromoform has no injurious action upon the broncho-pneumonia. Cases of whooping-cough should remain absolutely in-doors, but it is advantageous to change the case into a different room for the night. So soon as the whooping character of the cough has disappeared, change of air is recommended, especially to the sea-side. Marfan (*Jour. de Méd.*, Mar. 10, '98).

Whooping-cough treated with bromoform for the last six years with remarkable benefit in some cases, while the drug did not seem to affect others. The poisonous effect of the drug must be strenuously guarded against. The practice of giving it in drop form is not safe. Cohn (*Ther. Monats.*, Jan., '99).

The pneumogastric nerves are responsible for all the various forms of spasmodic cough, including pertussis. Counter-irritants over these nerves in the region of the neck procure signal benefit in this disease. Mustard applied along the area of the pulsating carotid artery from the angle of the lower jaw to the clavicle on both sides, three times a day, or painting the same area with tincture of iodine, twice a day, until irritation of the skin is produced, are very beneficial. In very stubborn cases hypodermic injections of silver nitrate over the vagi can be resorted to after injecting 5 minims of a 2½-per-cent. solution of cocaine hydrochloride. The needle is left in after injecting the cocaine, the syringe washed out, and 3 to 6 minims of a 2½-per-cent. solution of silver nitrate are then drawn in and injected. T. J. Mays (*N. Y. Med. Jour.*, Sept. 7, 1901).

Experience with the Naegeli maneuver for overcoming whooping-cough shows that pulling the lower jaw downward and forward controls the paroxysms of

whooping-cough in most instances, and most of the time. The method is usually more successful in older children than in younger ones and infants. In cases without a whoop the expiratory spasm, with its asphyxia, is generally overcome, and in those with a whoop the latter is prevented. As a single therapeutic measure for the control of the paroxysms it deserves a place in the treatment of pertussis and is as successful as any single drug, or even more so. Mothers, nurses, and other attendants, should be instructed in its use in order that the oncoming attacks, especially at night, might be arrested. The manipulation is harmless, painless, and easy of application, without any of the ill effects of drugs; it offers a maximum good effect with a minimum derangement. The only contraindication to its application is the presence of food in the mouth or œsophagus. Patients treated in this manner are less likely to suffer from complications and sequelæ than those treated only medicinally; they emerge from the disease in far better condition, less exhausted and less emaciated, because vomiting has been controlled. It is advisable to try the maneuver in other spasmodic coughs and laryngeal spasms (*larangismus stridulus*, pressure of enlarged cervical and bronchial glands, influenza, and glottis spasm in catarrhal laryngitis), although the author's experience seems to show that it is far less efficacious in these conditions than in whooping-cough.

This method being directed mainly to the control of the glottis spasm, does not preclude the advisability of supporting and sustaining the patient, guarding his gastrointestinal tract, establishing equilibrium in the nerve centers and affording him every possible hygienic advantage. It is particularly indicated in instances complicated with diffuse bronchitis, broncho-pneumonia, convulsions, epistaxis, subconjunctival or subcutaneous hæmorrhage, or sublingual ulceration, and in those children who by virtue of age, the presence of rachitis, scrofula, or general debility are predisposed to serious complications and se-

quelæ. J. Sobel (Archives of Pediatrics, June, 1903).

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PETROLEUM. — Petroleum (rock-oil, coal-oil, mineral oil) is found in various regions of the world. In the natural state it varies in color from a light green or red to black, more rarely clear. It has a distinctive odor. Some specimens have a very offensive odor due to the presence of numerous sulphur and phosphorus compounds. Barbadoes tar, Seneca oil and Rangoon oil are thick varieties. The Rangoon oil contains a larger proportion of both the olefin and the benzol series than American oil. Petroleum does not saponify. It is soluble in fixed and volatile oils and in ether, in 64 parts of boiling absolute alcohol, but is nearly insoluble in water and in chloroform. It is a solvent for India-rubber and many resins. By fractional distillation and purification it yields a variety of commercial products, the lighter oils being useful as solvents, the heavier being used for light, fuel, and lubrication.

All that portion which distills over at or below 122° F. is designated benzene, or naphtha. Hydrocarbons of greater volatility are obtained from naphtha by repeated fractional distillation. Rhigolene is obtained by distillation from naphtha, distilling over at 64.5° F.

By distilling off the lighter and more volatile portions of American petroleum and purifying the residue, petrolatum, or petroleum-jelly, is obtained. Petrolatum is an amorphous pale-yellow to white, odorless, tasteless, or nearly so, transparent, fatty substance, more or less fluorescent. Petrolatum is sold as cosmolin, vaselin, albolene, etc. It does not become rancid, and is in most cases a valuable substitute for lard in the prep-

aration of ointments. It can also be obtained as a semiliquid or liquid oil.

Preparations and Doses. — Petroleum (rock-oil), crude, 1 drachm; refined, 10 to 30 drops.

Petrolatum liquidum, U. S. P. (liquid petrolatum).

Petrolatum molle, U. S. P. (soft petrolatum).

Petroleum spissum, U. S. P. (hard petrolatum; consistency of a cerate).

Benzinum, U. S. P. (petroleum-ether, or petroleum-benzin), 10 to 30 minims, in mucilage or capsule.

Rhigolenum (rhigolene; used in spray for local anæsthesia and thermocautery).

Physiological Action. — Petroleum when taken internally in small doses is stimulant, antispasmodic, diaphoretic, antiseptic, and expectorant. It disinfects the gastro-intestinal and respiratory tracts. In large doses it gives rise to headache, vertigo, pain in the stomach, palpitation of the heart, vomiting, and tetanic spasm.

Poisoning by Petroleum.—In poisonous doses it produces a burning sensation throughout the alimentary tract. The excreta are covered with oil. The skin becomes cold; the pulse feeble, but regular; the respiration sighing, with great thirst and restlessness. Death may occur by collapse from failure of respiration and circulation.

In petroleum poisoning a distinction must be made according as to whether the petroleum-vapor is inhaled or the oil has been rubbed into the skin or has been taken internally. It would appear, according to Lewin's researches, that among workers in petroleum-springs no ill effect is produced; that is, as long as the vapor is inhaled in the open air; but in factories similar symptoms are produced as by ordinary gas. A feeling of exhilaration is first induced, then heaviness in the head, vertigo, loss of consciousness, or anæsthetic sleep. Cyano-

sis, contracted pupils, and vomiting may occur. Once a fatal result was seen. Chronic bronchitis with anæmia may appear after long exposure to the vapor.

Petroleum applied to the skin may induce moderately serious symptoms. A diffuse inflammation of the cutis may occur in severe cases. When petroleum has been taken internally the symptoms have not always been in proportion to the amount taken. There are two sets of symptoms: (1) gastro-intestinal, the kidneys being also involved; and (2) nervous. In the former case there is vomiting as well as the local irritation in the mouth and gullet. Diarrhœa, with colic, may supervene. In the cerebral form there is headache, anxiety, vertigo, and the pulse is small and infrequent; collapse may occur. Tetanic convulsions have been seen. A marked petroleum-smell has been noted in the sweat and also in the urine, which may sometimes smell of violets. The urine may also contain albumin and formed elements. Johannessén (Berl. klin. Woch., Apr. 20, 27, '96).

In a case of petroleum poisoning in a child of 1 $\frac{3}{4}$ years, the gait became ataxic. The child became semiunconscious, as if thoroughly drunk; the pulse rapid and irregular, the respirations very rapid, and the temperature subnormal. Symptoms improved after lavage. H. Conrads (Berl. klin. Woch., Nov. 2, '96).

Nine cases of poisoning with benzin, 4 of which were fatal, observed in a factory where a solution of rubber in benzin was used. Symptoms of poisoning were cephalalgia, vertigo, vomiting, throbbing, anæmia, and, above all, cutaneous hæmorrhages, and sometimes hæmorrhages of the gums, the stomach, and the genital organs. There was no icterus. Progress of these symptoms were subacute, and the disease lasted several weeks. In 1 case, which had terminated fatally, microscopical examination of the organs had revealed the existence of fatty degeneration of the heart, the liver, the kidneys, the pelvic organs, and the endothelium of the blood-vessels. From results of experiments on rabbits, it was concluded that the benzol had been the toxic constitu-

ent of the benzin in these cases. M. Santesson (Gaz. Heb. de Méd. et de Chir., Aug. 26, '97).

Case of a man who presented some rare hæmorrhagic spots on his body, but especially nasal and gingival hæmorrhages, and hæmorrhagic pleurisy. He died suddenly in a condition of extreme anæmia. At autopsy pleural hæmorrhage was found; there was also myocardiac and endocardiac infarcts, ecchymoses in great abundance on the mucous membrane of the stomach and intestine, and two hæmorrhagic centres in the left optic layer and in the pons Varolii. Onset of symptoms had been characterized by large subcutaneous ecchymotic patches. Patient had gradually become weakened and been obliged to give up his work, which exposed him for days at a time to benzin-vapors. He had experienced a sort of intoxication, headache, nausea, and general malaise, which had still persisted after he had left the work-room. M. le Noir and M. Claude (Gaz. Heb. de Méd. et de Chir., Nov. 14, '97).

Treatment of Petroleum Poisoning.—Poisonous symptoms demand the evacuation of the stomach by siphon or emetics, the exhibition of stimulants, and the application of warmth and stimulants to the skin. Artificial respiration may be necessary.

Case of child, 21 months old, which drank indefinite amount of benzin. In from half to three-fourths of an hour the child was perfectly unconscious; pupils were dilated to maximum; skin was cold and cyanotic; the breathing was shallow and rapid, and pulse was barely perceptible. Stomach was washed out and milk was thrown into it, injections of ether were given, and a lukewarm bath was administered, with cold affusions. Urine, passed spontaneously, was free from albumin and sugar; temperature was 101.6° F. After a very restless night temperature was 99.5° F., but by evening it had risen to 102.5° F. On following day child was conscious, but in middle of the day the temperature was 104.3° F. On the next day the

morning temperature was 99.8° F., and the evening 100.7° F. Rapid recovery then followed. Fever was attributed to acute gastritis. Witthauer (Münch. med. Woch., No. 39, '96).

Therapeutics.—Internally the crude oil has been given in teaspoonful doses to children suffering with whooping-cough and croup. In chronic bronchial disorders it has been found useful, given internally. Crude petroleum was at one time considered a specific against phthisis.

Petroleum emulsion commended as useful in consumption. Many patients, consumptive or subject to other wasting diseases, appear to tolerate its use when codliver-oil cannot be tolerated. It probably checks noxious chemical fermentation, and the absorption of such noxious fermented residue of digestion into the blood. At all events, it is clear that petroleum does not irritate the nerves supplying the mucous membrane of the stomach, but doubtless cleanses away foul mucus, and leaves the digestive organs in a more healthy condition to perform their functions naturally. Nutrition is improved, therefore the condition of the lungs improves when weakened and diseased. T. W. Blake (Brit. Med. Jour., Nov. 19, '97).

Petrolatum when given internally passes unchanged through the intestinal canal. Whatever beneficial effects it may exert in the stomach and intestine are due to its lubricating and demulcent properties. A further incidental proof of the non-absorbability of paraffin and its compounds is shown by recent experience in its attempted use in surgery. Reyburn (Medical News, Aug. 24, 1901).

Hutchinson has found that it possesses no value as a food. It is not absorbed, for after feeding healthy persons with petroleum, he was able in every instance to recover the entire amount from the fæces. It is useful, however, as a protective to the intestinal tract and as a vehicle for carbolic acid and other anti-

fermentatives. As a gastro-intestinal protective it may be given in capsules. Petroleum has been given as a vermifuge; 20 to 30 drops three times daily are said to expel tape-worms. In cholera, refined petroleum has been given with success in doses of 10 to 20 drops in mint-water or white wine.

DISORDERS OF RESPIRATORY TRACT.—The inhalation of petroleum-vapor has been recommended in asthma.

Refined petroleum has been successfully used as a local application to dissolve the false membrane in diphtheria. For this purpose, it may also be used as a gargle. Sajous has found it useful in follicular tonsillitis applied with cotton pledget. Petroleum vaporized in the room of patients suffering from diphtheria has been found beneficial. Petrolatum liquidum is useful, in spray, in cases of acute and chronic rhinitis as an emollient protective.

AS LUBRICANT.—Petrolatum liquidum is also a desirable lubricant for catheters, bougies, and other instruments. This preparation alone should be used for this purpose, as vesical calculi have been examined which seemed to have as a nucleus a small portion of petrolatum molle, or petroleum-jelly.

Petrolatum molle is useful as a basis for ointments and as an emollient dressing for sores and skin affections.

EXTERNAL USE.—Externally petroleum is used as a counter-irritant in chronic rheumatism, synovitis, sprains, chilblains, and paralysis, and over the throat and chest in inflammatory disorders of the throat and air-passages. It is used alone or combined with other drugs in chronic and parasitic skin diseases; it has been found beneficial in psoriasis, eczema, seborrhœa, scabies, and in alopecia. It has also been used externally in epithelioma and cancer.

Benzin employed with success in skin diseases of mycotic origin, especially in the ordinary furuncle. It is an excellent parasiticide. F. W. Langdon (Cincinnati Lancet-Clinic, Feb. 7, '91).

Rhigolene is a very volatile product of petroleum. So very rapid is its evaporation that a spray of rhigolene will produce a local temperature of 15° F. It should be kept in tightly-corked bottles and in a cool place.

It is used to produce local anæsthesia for minor surgical operations. It is the liquid employed for use in Paquelin's thermocautery. The use of rhigolene in the vicinity of lights is unsafe. It has also the disadvantage of possessing an unpleasant, garlicky odor.

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PHENACETIN.—Phenacetin (paracet-phenetidin; acet-phenetidin, or oxyethyl-acetanilid) is a coal-tar product, analogous to antipyrine and acetanilid, introduced in 1887 by Hinsberg and Kast as an antipyretic remedy. Phenacetin occurs in colorless, tasteless, inodorous, glistening, scaly crystals melting at 275° F. It is sparingly soluble (1 to 1500) in cold water, but more freely in boiling water (1 to 70) and in alcohol (1 to 16).

Identifications and Tests.—Phenacetin is identified by the production of a deep-red color when chromic acid is added to a cooled and filtered solution of 1 grain in 20 minims of hydrochloric acid diluted with 10 times its volume of water (Ritsert). Its freedom from acetanilid is insured by the isonitrile test, and by providing that a cold, saturated, aqueous solution shall not become turbid on addition of bromine-water. Lastly, sulphuric acid must dissolve it without color, and, heated with free access of air, it burns, leaving no residue. Autenrieth and Hinsberg give a later test:

Cover finely-powdered phenacetin with 10 to 12 per cent. nitric acid and heat to boiling; an intense yellow nitro-compound is formed which on cooling separates in yellow needles; antipyrine and acetanilid are unaffected under the same conditions.

If paraphenetidin is present in phenacetin, it will produce irritation of the kidneys, and in consequence may cause grave complications. Reuter gives a test for the presence of this impurity: Melt 40 grains of chloral-hydrate in a water-bath and then add 8 grains of phenacetin, shaking the mixture well. If traces of the impurity be present, the solution is colored immediately violet, then red, and finally blue.

Physiological Action.—Phenacetin, according to Mahnert, is antagonistic to strychnine in its physiological action, the cardiac and respiratory centres being paralyzed by it. Ott observed that it decreased heat-production without modifying the blood-pressure, its antipyretic action being due, therefore, to its influence upon the nervous system. Cerna and Carter, on the contrary, found that (1) phenacetin, in moderate doses, causes a rise of the arterial pressure by acting upon the heart, and, probably, likewise by a stimulating influence exercised on the vasomotor system; (2) the reduction of the pressure by the drug in large amounts is mainly of cardiac origin; (3) the remedy increases in small doses the force of the heart by direct action; (4) phenacetin increases the pulse-rate chiefly by cardiac stimulation, and, possibly, also, by influencing the cardio-accelerating apparatus; (5) the drug reduces the number of pulsations; especially in large quantities, primarily by stimulating the cardio-inhibitory centres, and, later, by a depressant action upon the heart.

Regarding the action of phenacetin on heat-phenomena; these observers contend that both in septic and albumose fevers it produces a very slight fall of temperature during the first and second hours after its ingestion by the stomach, but that the greatest reduction occurs the third hour after its administration. The fall of temperature results chiefly from a decrease in heat-production, with a slight increase in the heat-dissipation. The increase in dissipation is not so great as with antipyrine. Probably the delayed action of the drug depends on its insolubility.

The moderate dose of phenacetin is without any distinct action on any vital organ. Large doses lessen reflexes by a direct action on the spinal cord. Doses of 0.5 gramme per kilo of body-weight (equivalent to a little less than 1 ounce for a 150-pound man) kill by arrest of respiration. Doses even up to 0.5 gramme per kilo had no distinct effect on the circulation. H. C. Wood, Jr., and H. B. Wood (Univ. Med. Mag., July, 1900).

Poisoning by Phenacetin.—Although phenacetin in ordinary medicinal doses has been considered to be free from ill effects, an editorial writer (Brit. Med. Jour., Dec. 22, '94) states that, nevertheless, unpleasant and profuse diaphoresis may render its habitual use in phthisis and enteric fever undesirable; collapse and exhaustion are not unknown even after medium doses, while palpitation and oppression of breathing followed by nausea and vomiting have been likewise observed. Cutaneous eruptions, chiefly urticarious, prevail with a frequency scarcely inferior to antipyrine; and cyanosis of the face, due to changes in the hæmoglobin, may be seen to a similar degree. In short, we may meet all the ill effects of the aromatic group, though the incidence is less.

Three doses, of 7 grains each, of phenacetin, produced in a woman severe præcordial pains, great dyspnœa, lividity of the whole surface of the body, and a state of collapse. She slowly regained consciousness under ammonia and alcoholic stimulation, but could not be about for a week. W. C. Hollopeter (Med. News, Sept. 21, '89).

Fatal case of phenacetin poisoning in a boy 17 years old, when 15 grains were to be taken twice daily. After an evening dose vomiting commenced, followed by great weakness and a bluish-gray color of the face and lips. The temperature was 102.2° F., the pupils of medium size, the pulse weak, and the patient complained of headache, vomiting, and diarrhœa. The conjunctivæ were slightly jaundiced. General icterus followed and cyanosis of the lips, ears, hands, and feet. The urine, obtained by catheter, was thick, dark-reddish brown in color, containing masses of almost pure blood. Death followed in two days from universal methæmoglobinæmia, as shown by the necropsy. G. Krönig (Berl. klin. Woch., No. 46, '95).

Treatment of Poisoning by Phenacetin.

—The treatment of poisoning by phenacetin is similar to that of poisoning by acetanilid and antipyrine (see ACETANILID and ANTIPYRINE, in volume i).

Therapeutics.—Phenacetin is generally conceded to be the ideal antipyretic. It is usually given in doses of from 5 to 10 grains; not more than 15 grains should be given. To children 2 to 4 grains may be given according to age. While phenacetin has little or no effect on the temperature in health, its antipyretic effect in febrile disorders is prompt and marked; it is the safest of all the coal-tar products.

Phenacetin is also used as an analgesic, and, although not comparable with morphine in the relief of pain, its anodyne influence is more marked than that of antipyrine or acetanilid. As an analgesic it will be found useful in neuralgias

of various kinds, migraine, headache from eye-strain, in the pains of *tabes dorsalis*, and in intercostal neuralgia.

Four cases of syphilitic and other ulcerations, which had proved rebellious to all other treatment, but which yielded rapidly to the local use of phenacetin. The phenacetin, finely powdered, is applied to the ulcerations. It acts as an analgesic, antiseptic, and stimulant. In specific ulceration an appropriate general treatment should be combined with the phenacetin. M. H. Lee (*Memphis Med. Monthly*, Oct., '92).

Phenacetin is useful in relieving the pain of acute rheumatism in doses of 3 to 8 grains given every four hours. A useful combination is 4 grains each of phenacetin and salol given three or four times daily. Phenacetin is also useful in subacute rheumatism, and in lumbar and other muscular pains.

Phenacetin has been much used in the early fever of influenza as an antipyretic.

Phenacetin applied locally gives satisfactory results in nasal catarrh. It may be administered in the form of snuff or dissolved in glycerin. J. S. Woodruff (*Jour. of Laryn., Rhin., and Otol.*, June, '97).

Derivatives and Allied Compounds.—

APOLYSIN.—Apolysin is made by replacing one atom of hydrogen in phenacetin by a citric-acid radical. It is much less poisonous than phenacetin and is used as a substitute for it. It occurs as a yellowish-white crystalline powder of a sour taste, less acid than citric acid, and of a characteristic odor. It is soluble in 25 parts of cold water and quite soluble in boiling water. It is freely soluble in alcohol and in glycerin. Its use is contra-indicated during fasting and when there are excessive acid secretions in the stomach (von Nencki and von Jaworski). Hare has tried this drug for painful affections and has been unable to discover

any advantage in it over phenacetin; the dose is 5 to 10 grains, 3 times daily.

Clinical observations regarding apolysin led to following conclusions: 1. Apolysin administered to fever patients lowers the temperature and at the same time prevents a series of co-existing symptoms, particularly pain. 2. Given to patients suffering with neuralgia, etc., it diminishes the violence of the pain, allays hyperæsthesia, shortens the duration of the attack, and often completely suppresses the symptoms. 3. Owing to its chemical properties, it acts promptly and regularly, and exercises no injurious effect on the organism. Its employment is contra-indicated during fasting and when there are excessive acid secretions in the stomach. 4. It is more soluble than other drugs in the same group, and consequently more promptly and more easily absorbed. Von Nencki and von Jaworski (*La Presse Méd.*, Oct. 26, '95).

Apolysin used in treatment of 46 patients: croupous pneumonia, 2; syphilis, 1; scarlatina, 1; pleuritis, 5; muscular rheumatism, 11; hemicrania, 5; angina follicularis, 1; caries vertebræ, 1; articular rheumatism, 5; neuralgic pains, 10; lumbago, 3; septicæmia, 1; *tabes dorsalis*, 3; typhoid fever, 1 case. Daily dose was from 45 to 105 grains. Conclusions are that this is an indifferent pharmaceutical product which possesses no analgesic and but very slight antipyretic and diuretic properties. V. Gez (*Wiener klin. Woch.*, No. 22, '96).

DULCIN.—Dulcin, valzin, paraphe-netolcarbamid, or sucrol, is a sweetening agent produced by heating phenetidin with urea. It is said to have 200 times the sweetening power of cane-sugar (Kobert) and not to give rise, on prolonged use, to the dislike following the use of saccharin. The bitter after-taste of saccharin is wanting in dulcin. Squibb mentions its great insolubility as its chief disadvantage. It crystallizes in small, white needles, which are soluble in ether, in 25 parts of alcohol, in 150 parts of boiling water, and in 800 parts of cold water. Dulcin has been used in the

place of sugar to sweeten the food of obese and diabetic patients. It may also be used to sweeten bitter preparations. Ewald has given it in daily doses of 24 grains. In moderate amounts it is considered harmless.

Dulcin has many advantages over saccharin. It has a pleasant and very sweet taste, and dissolves in 50 parts of boiling water. Personally used in 6 diabetic patients. One patient was under observation for over a year, and during the whole period dulcin was used with no unpleasant effect. It may be employed in doses of 0.025 grain, a quantity which corresponds to 5 grains of sugar. It may also be added at times to cooked articles of diet, such as sauces, jellies, fish, etc. S. Sterling (Münch. med. Woch., Dec. 16, '96).

IODOPHENIN.—Iodophenin, or iodophenacetin, is a reaction-product of phenacetin in hydrochloric acid and iodine in potassium iodide. It contains 25 per cent. iodine. It occurs in brownish-black crystals, having an iodine odor and a burning taste. It is soluble in alcohol and in water with the liberation of iodine. It is antiseptic in action and in solution acts like iodine solution. It is used externally like iodine, and as a substitute for iodoform.

Iodophenin employed in the treatment of purulent and infectious wounds and it was found that it equals corrosive sublimate and iodoform; however, since iodine is so easily liberated, the direct application of it is contra-indicated in fresh wounds. Ichorous ulcers of the leg became dry and aseptic after the second dressing of iodophenin in powder or glycerinated emulsion on cotton, and iodoform then accomplished a prompt cure.

As it exerts a slightly-caustic action on the granulations, after the wounds have become clean under its use it should be replaced by iodoform. Iodophenin is also serviceable after the extirpation of ganglia as well as after major surgical operations (resections, etc.) to prevent decomposition of secretions in contact

with bandages. It is preferable not to sprinkle the wounds directly, but to use it between the layers of the cotton dressing, which may be left in place for two to three weeks without becoming putrid, even in cases of very abundant secretion from non-aseptic wounds. Schüller (Wiener med. Presse, Jan. 14, '94).

LACTOPHENIN.—Lactophenin, or lactyl-phenetidin, is a derivative of phenetidin with lactic acid. It occurs as a white powder, sparingly soluble in water. Lactophenin has antipyretic, antineuralgic, analgesic, and hypnotic powers. In some cases it gives rise to diaphoresis and slight vertigo; sometimes it causes a sense of heat and weight in the epigastrium, but it does not continue long. Cases have been reported in which a rash appeared after the administration of the drug. Lactophenin has been given in pneumonia, influenza, erysipelas, scarlatina, acute tuberculosis accompanied by fever, and in septicæmia. Eight to 15 grains produces a decided, but gradual, fall of temperature, which persists for several hours. Lactophenin quiets delirium. Roth found it beneficial in acute rheumatism. It has been used with success in some cases of chorea and in the pains of locomotor ataxia.

Lactophenin acts precisely like phenacetin when both are given in 9 1/4-grain doses, but 15 1/2 grains of lactophenin produce a decidedly hypnotic effect. Landowski (Lancet, Apr. 21, '94).

Catarrhal jaundice following the use of lactophenin and apparently due to the drug as seen in three instances. In each case the drug was being administered for neuralgia and a dose of 15 1/2 grains was being taken four times *per diem*, the length of time before the jaundice appeared varying from fourteen to twenty-one days from the commencement of the treatment. The jaundice appeared to be of the ordinary catarrhal type, the stools being white and the urine bilious. Strauss (Therap. Monats., Sept., '95).

It is questioned whether the remarkable remissions in temperature produced by lactophenin are not in reality due to a state of collapse. F. Kolbl (Wiener med. Presse, Oct. 20, '95).

METHACETIN.—Methacetin, para-acetanisidin, or para-oxyethyl-acetanilid, is a homologue of phenacetin. This compound differs from phenacetin only in containing a methyl in place of an ethyl group. It occurs in a white micro-crystalline powder of a feeble bitter taste, and is soluble in alcohol, chloroform, dilute acids and alkalis and slightly soluble in water (1 to 300). It is an antipyretic, antineuralgic, antiseptic, and antifermentative. It has been used in pneumonia, typhoid fever, phthisis, scarlet fever, rheumatism, and various forms of neuralgia, in doses of 4 to 8 grains for an adult and 2 to 5 grains for children. In phthisis its action is not favorable, as it gives rise to copious diaphoresis.

Methacetin, employed in a series of observations in health and disease, was found to produce in all instances a lowering of the temperature, this being its most important action. In disease the effects were more remarkable than in health. The affections treated were pulmonary tuberculosis, typhoid fever, acute articular rheumatism, and pleurisy, and in these the diminution of temperature under the influence of the drug was more or less pronounced, according to the case. Pescarolo (Gaz. degli Osp., Nov. 27, '89).

THYMACETIN.—Thymacetin is a derivative of thymol, and is closely allied to phenacetin. It bears the same relation to thymol that phenacetin does to phenol. It occurs as a white, crystalline powder, soluble in alcohol and ether, and slightly soluble in water. It is an analgesic, hypnotic, and antiseptic, and has been used in headache, neuralgia, paralysis, insomnia, and delirium, in doses of from 5 to 15 grains, three or

four times daily, best given in capsules or wafers.

C. SUMNER WITHERSTINE,
Philadelphia.

PHENIC, OR CARBOLIC, ACID AND DERIVATIVES.

Phenic or phenylic acid, carbolic acid (acidum carbolicum, U. S. P.), phenol, phenyl-hydrate, phenylic alcohol, or coal-tar creasote obtained by fractional distillation, at 338° to 446° F. Pure carbolic acid (acidum carbolicum, U. S. P.) occurs in long, colorless needles, melting at 95° F. and having a characteristic odor and, when highly diluted, a sweetish taste. Carbolic acid deliquesces in moist air and becomes red on exposure to the light. It is freely soluble in alcohol, ether, chloroform, and glycerin, and slightly soluble in water. The pharmacopœia recognizes a crude acid (acidum carbolicum crudum, U. S. P.), which is a mixture chiefly of cresol and phenol and occurs as a dark, oily liquid, having a strong tar odor, and is partly soluble in water. This crude acid is used chiefly for disinfecting purposes either in solution (1 in 50 to 200) or mixed with chloride of lime, slaked lime, etc.; the crude acid is not adapted for wounds. Between these official preparations there are others of various grades of purity. Five grades, known by numbers, are made. The pure acid in colorless crystals is known as number one, and is alone fit for internal use. Number two is also crystalline. Numbers three, four, and five are impure, containing other ingredients of coal-tar, especially cresol.

The crystals of pure carbolic acid may be liquefied by the addition of 5 per cent. of water, a clear solution resulting; the further addition of water produces turbidity until the proportions are reversed (1 to 20), when it becomes per-

manently clear and remains unaffected by further dilution.

Preparations and Doses.—*Acidum carbolicum*, U. S. P. (pure crystals), 1 to 3 grains.

Acidum carbolicum crudum, U. S. P. (impure, 90 per cent.), for disinfection.

Glyceritum acidi carbolici, U. S. P. (glycerite, 20 per cent.), 2 to 5 minims.

Unguentum acidi carbolici, U. S. P. (ointment, 5 per cent. carbolic acid).

Physiological Action.—Locally, carbolic acid is an energetic caustic, in dilute solution an irritant. In concentrated form, when brought in contact with the tissues, it causes rapid disorganization of the part and the formation of a hard mass, which does not disappear for some time. If one of the extremities be immersed in a comparatively weak solution of the drug, a contraction of the capillaries and consequent pallor of the skin results, with a certain amount of local anæsthesia—a stronger solution producing some preliminary burning. Upon the mucous membrane the acid causes, first, a sensation of burning pain, then anæsthesia, leaving a white eschar (Pouchet).

When administered internally in toxic doses it gives rise to convulsions of spinal origin, to which are added at first increased reflex activity. This being followed by paralysis, it is evident the spinal centres are first stimulated, then depressed. The nerves and muscles, as shown by Salkowski and Hoppe-Seyler, are not distinctly paralyzed however, since they respond actively to galvanic stimulation (Wood). The arterial pressure is reduced and the heart depressed. Gies has shown that carbolic acid paralyzes the vasomotor centre in the medulla before affecting the heart. The condition of the blood induced in animals is one of oligocythæmia rather than

oligochromæmia, as the reduction of blood-corpuscles is not accompanied by any alteration in the percentage of hæmoglobin (W. J. Wilkinson). Respiration is at first greatly increased in frequency, owing, mainly, to a stimulating influence exerted upon the respiratory centres during the first stages and in part to stimulation of the peripheral vagi (Salkowski). As to the effects on temperature, H. C. Wood concludes from the experiments of H. A. Hare and E. Erls that carbolic acid may affect the thermogenic functions in two ways: first, by diminishing the production of heat; second, by increasing the dissipation of heat.

Carbolic acid coagulates albumin, and in sufficiently strong solution is poisonous to all forms of life, its main use in practice depending upon its ability to destroy micro-organisms rather than as a stimulant.

Poisoning by Phenic (Carbolic) Acid.

—Carbolic acid is a most deadly poison and acts rapidly. Six or seven drops have caused the most dangerous symptoms. Death may be expected to follow almost immediately after taking any large quantity. Death has taken place within ten minutes after swallowing about one ounce of carbolic acid, although life may be protracted two or three days. If a large dose be swallowed one may drop dead before he can get more than a few feet from the spot where he stood or he may live a few hours. Sudden death is due to failure of respiration. If death is delayed, symptoms of violent gastroenteritis ensue. The symptoms of poisoning are vertigo and intoxication, accompanied with vomiting of frothy mucus, and an intense burning pain in the mouth, œsophagus, and stomach. The pupils are contracted, the pulse rapid and intermittent, and coma, collapse, or convulsions ensue. The skin

is covered with a clammy sweat, the features are pinched and anxious, and the pulse becomes very thready and almost imperceptible, as a rule. White eschars are noticed about the mouth, if the pure acid has been taken, or blackish, if the impure drug has been used. The odor is apt to hang about the person or clothes. The urine is frequently suppressed, but, if passed or withdrawn by catheter, is dark colored and smoky. Convulsions or coma often close the scene. A very common symptom (Hare) is hoarseness of the voice, due to an effect on the larynx after the drug is absorbed, and not from its local influence. Cases are on record where carbolic-acid poisoning has been due to its absorption from surgical dressings. In these cases a darkened, smoky hue of the urine, with slight nervous unrest or cerebral disturbances, is present. Pain in the lumbar region is another indication of this condition, and should suggest the removal of the dressings.

In five autopsies of carbolic-acid poisoning noted the tongue, gums, and, in fact, the whole mouth were colored white. This discoloration also affected the whole alimentary tract. The mucosa of the œsophagus was smooth and white and could be easily stripped from the muscularis. The kidneys showed, in 1 case, principally interstitial changes; in the others the parenchyma of the organ was mainly involved. In 3 of the cases the lungs were congested and cedematous. The remaining internal organs presented no lesion which could be ascribed to the acid. William Moser (Brooklyn Med. Jour., Jan., '96).

In the United Kingdom in the period 1861-65 the suicides by carbolic acid were 0.00 per cent. of all suicides with poisons; in 1866-70 they were 1.00 per cent.; in 1871-75, 5.82 per cent.; in 1876-80, 7.93 per cent.; in 1881-85, 15.37 per cent.; in 1886-90, 15.49 per cent.; and in 1890-94 (four years), 28.01 per

cent., thus showing that the sale of carbolic acid should be restricted as is that of the recognized poisonous substances. A. E. Harris (Lancet, Nov. 28, '96).

One-third of the males and very nearly one-half of the females who poisoned themselves in 1895 did so with carbolic acid. These figures speak eloquently in favor of some restriction in the sale of carbolic acid to the general public. The time has come when a poison which accounts for 244 suicidal deaths out of a total of 580 caused by poison in one year, should be placed out of reach of the general public. Mann (Med. Chronicle, May, '97).

Physicians cannot too often caution the public against the prolonged topical application of carbolic acid even in the weakest solutions. Among 20,417 patients treated in the surgical service of the hospital belonging to the Allgemeine Arbeiterkrankenkasse, carbolic-acid gangrene was observed in 26 cases—in 12 after the topical employment of weak solutions and in 14 as the result of the use of the concentrated acid. In nearly every instance the drug was used without medical advice, in the form of a solution kept applied continuously. J. Levai (Pester med.-Chir. Presse, Nos. 8, 10, 11, and 12, '97).

From Levai's *data* and from observations made on out-patients of the Tübingen clinic, it is estimated that one case of carbolic-acid gangrene occurs in every thousand surgical patients. In literature are found 43 examples sufficiently described; in 30 of them the strength of the solution was from 1 to 5 per cent. The thromboses found are not the cause of the gangrene, but only an accompaniment. As compared with that due to the other caustics mentioned, there is nothing specified in the gangrene induced by carbolic acid; it acts by giving rise to excessive transudation into the subcutaneous cellular tissue, and so choking the circulation, especially in the fingers. The most effective prophylactic would be to restrict the sale of carbolic acid. Honsell (Beit. zur klin. Chir., xix, 9; Centralb. f. Chir., Mar. 5, '98).

Fatal case in an infant, 7 days old, due

to accidental application over the right inguinal region of only enough carbolic acid to make two eschars, one the size of a quarter, the other that of a dime. Death occurred ten hours after the first convulsion, the latter ceasing two hours before death. Cyanosis and spasm of the face continued to the end. The nurse had been preparing a carbolic douche for the mother; accidentally she touched the pure carbolic acid with her thumb and index finger and immediately after touched the baby with the moist fingers. Five minutes later the convulsions began. R. Abrahams (Pediatrics, Mar. 15, 1900).

Carbolic acid in concentrated solution is relatively less toxic than when diluted, its penetrability during its brief influence is but slight, and the bactericidal action of pure carbolic acid surpasses that of sublimate in albuminous compounds. It has personally been employed in more than eighty cases of infected wounds, plegmons, suppuration of joints, etc. After incision, and subsequent curetting or excision of the wound, the surrounding skin is protected against the excess of carbolic acid by wetting it with absolute alcohol; the wound is then thoroughly swabbed with a gauze sponge previously immersed in pure carbolic acid. The amount of carbolic acid employed depends upon the size of the wound, but more than 2-6 grains was not even used in the largest wound. The pure carbolic acid is applied for one minute, followed by immediate irrigation with absolute alcohol. Von Bruns (Phila. Med. Jour., May 18, 1901).

Treatment of Poisoning by Phenic (Carbolic) Acid.—The soluble sulphates are chemical antidotes to carbolic acid, their combination forming insoluble sulphocarbolates. Epsom, or Glauber's, salts in solution readily follow the acid into the vessels and tissues of the body and combine at once with it. They should, therefore, be given even if hours have elapsed since the poison was taken. Liquor calcis saccharatus, or syrup of lime, is also a useful antidote. Warm mucilaginous drinks may be given to

soothe and protect the inflamed digestive tract. Oils should not be given, as they dissolve the acid and favor absorption. Collapse requires hypodermic injections of digitalin and strychnine, and friction and hot applications to the extremities. Failing respiration calls for atropine injections; pain may be relieved by injections of morphine and counter-irritation over the abdomen. Emetics will not act on account of the condition of the stomach; the stomach-pump is generally contra-indicated on account of the lesions along the œsophagus and in the stomach. If the patient survive, small doses of the soluble sulphates may be given at stated intervals for several days, to counteract any acid that may have been absorbed.

In the treatment of poisoning by carbolic acid, 30 to 60 minims of sulphuric ether should be injected immediately by hypodermic syringe. A rectal injection of 2 ounces of sulphate of sodium in 3 pints of filtered water is then given, the bowel being irrigated as high as possible after the manner of Cantani.

By the mouth or by means of an œsophageal tube 1 ounce of sulphate of magnesia in a quart of hot water is to be administered, as this will form an innocuous sulphocarbolate with the carbolic acid. It may be necessary, also, to bleed the patient and then to perform intravenous transfusion or hypodermoclysis, the injection consisting of 300 grains of chloride of sodium in a quart of boiled distilled water. Morphine and heat should be applied to the extremities, and, if the fluid which has been injected into the rectum to wash it out has passed away, a small injection of strong black coffee should be given as a respiratory stimulant. Tea and hot punch may also be administered. Landouzy (La Presse Méd., Mar. 19, '98).

Case of woman who swallowed 7 drachms of ordinary commercial carbolic acid. She was comatose and collapsed and death seemed imminent. The stomach was washed out with water contain-

ing sodium sulphate; 8 ounces of blood were removed from the saphenous vein and 4 pints of a normal saline solution at a temperature of 100° F. were injected into the vein. Atropine sulphate, $\frac{1}{60}$ grain, was administered hypodermically, and half a pint of milk, beaten up with 2 eggs and 1 minim of croton-oil, was introduced through the stomach-tube. Recovery was eventually complete. T. Oliver (*Lancet*, Mar. 19, '98).

Case of carbolic-acid poisoning from use of vaginal douche. Large eschars formed wherever solution had touched. Syringing with warm solution of sodium sulphate, a drachm to the pint, produced relief in ten minutes, absolute freedom from pain in a half-hour; saturated cloths were kept on the blistered parts all night and complete recovery was obtained within twenty-four hours. Carbolic acid, so called, is not really an acid; and hence alkaline solutions are of no avail. Sodium sulphate forms with the carbolic acid sodium sulphocarbolate, which is soothing in effect and prevents further damage. B. Weiss (*N. Y. Med. Jour.*, Jan. 7, '99).

Case of woman, who had swallowed over an ounce of 95-per-cent. carbolic acid. A short time after her swallowing of the acid hypodermic of sulphate of sodium was given. Then the stomach was washed with a 35-per-cent. solution of alcohol, about 2 quarts of the alcohol solution being used. The patient entirely recovered, although her face was badly burned with the acid and the mucous membrane of the mouth seemed entirely destroyed. This is believed to be the first time that alcohol has been used internally for the burns of carbolic acid. J. Drysdale Buchanan (*Med. Rec.*, Aug. 12, '99).

Alcohol will prevent and remove the caustic and poisonous effects of carbolic acid. The primary step in poisoning is to wash the stomach out with alcohol; then whisky may be given hypodermically with the idea of neutralizing the acid in the blood. Other heart-stimulants may be required. As the acid is quite rapidly taken up into the blood, it has been suggested that no treatment is complete without bleeding, but that has

not been done to any great extent. Alcohol is the most perfect, the most certain, and the most handy antidote to carbolic acid. G. W. Sargent (*Therap. Gaz.*, Dec. 15, 1901).

Personal record kept of seven cases of internal poisoning by carbolic acid, either from intent or otherwise, whose lives have been saved by administration of about twice the amount of alcohol as carbolic acid. It is a well-established fact that when carbolic acid is mixed with whisky or brandy it will not kill. Information such as this should be disseminated through the public press, and physicians should see to it that the people are made aware of these facts. S. D. Powell (*Amer. Jour. of Surg. and Gynec.*, April, 1902).

Case of carbolic acid poisoning which illustrates the value of prompt and persistent treatment. The patient, a child two years of age, swallowed some strong carbolic acid. It took a few steps and fell limp and unconscious. It was seen ten minutes later. At this time the pulse could not be obtained at the wrist. In rapid succession a considerable number of subcutaneous injections of brandy were given and $\frac{1}{60}$ grain of strychnine. A soft-rubber catheter attached to a glass syringe served as a stomach pump, with which the stomach was emptied, and the whites of two eggs and half an ounce of brandy introduced through the tube. The pulse and respiration continued fair for about half an hour when the respirations failed. In spite of the Sylvester method of artificial respiration the cyanosis increased, the pupils dilated, and the muscles were rigid. At this crisis the lungs were filled several times by mouth-to-mouth insufflation before the least tendency to automatic breathing became apparent. In ten minutes these efforts were successful and respiration was restored. W. W. Harvey (*Boston Med. & Surg. Jour.*, June 16, 1904).

Therapeutics. — ORAL DISORDERS. — Solutions of carbolic acid have been recommended in stomatitis, a spray of 1 grain to the ounce of water, or a mouth-wash or gargle containing 2 to 5

grains to the ounce of water may be used. Offensive breath may be sweetened by the use of a 5-per-cent. spray. The cavity of a carious tooth may be packed with a pledget of absorbent cotton dipped lightly in a concentrated solution of carbolic acid to relieve the pain. In diphtheria and fœtid sore throat a 2- to 5-per-cent. solution may be used with brush or atomizer.

GASTRO-INTESTINAL DISORDERS.—In nervous vomiting or that due to gastric irritation $\frac{1}{2}$ - to 2-drop doses will afford relief by the depressant action of the acid on the nerves of the stomach. Fermentative diarrhœa is well treated by giving 2 to 4 drops of carbolic acid combined with 10 to 20 grains of bismuth in powder or capsule. Cholera infantum and cholera morbus are amenable to similar treatment if fermentation is present.

Vomiting after ether can be stopped by giving $\frac{1}{4}$ drop of carbolic acid every hour for a few hours. W. W. Keen (College and Clin. Rec., Nov., '94).

RESPIRATORY DISORDERS.—Weak solutions of carbolic acid are of value in chronic and atrophic rhinitis, coryza, hay fever, and influenza; the solution (2 to 5 grains to the ounce) is best used in spray. The familiar "Dobell's solution," used for cleansing the nares previous to making applications, contains a small amount of carbolic acid.

A solution (5 to 15 drops of acid to the ounce of water) inhaled by means of very fine spray is beneficial in gangrene of the lung and in pulmonary tuberculosis; it controls the cough and relieves the tickling in the throat. For this and other uses about the respiratory passages, beech-wood creasote is to be preferred.

FEVERS AND SEPTIC DISORDERS.—A favorite treatment for enteric fever with some is a combination of 1 part of carbolic acid and 2 parts of tincture of

iodine; 2 or 3 drops are given in mint-water every three or four hours. R. H. Quill uses carbolic acid and spirit of chloroform (3 to 10). Charteris advises $2\frac{1}{2}$ grains, absorbed by some inert powder, in pill coated with keratin.

Results of carbolic-acid treatment in typhoid wards of General Hospital, Nowshera, India: 79 cases were treated, with 11 deaths, giving the average mortality of 13.9 per cent. On arrival of patients, after being washed and placed in bed, carbolic acid was prescribed, four doses of 4 minims each, well diluted with iced water, being ordered in the twenty-four hours. This was supplemented during the night, if the skin was hot and burning and the temperature running high, by two full doses of ordinary diaphoretic mixture. Formula generally used for carbolic acid was Calvert's pure carbolic acid, 4 minims; spirit of chloroform, 15 minims; compound tincture of cardamoms, 20 minims; with syrup and water to 1 fluidounce. This mixture was kept in the ice-box. Without any exception it was well tolerated by the stomach and caused no unpleasant symptoms. Complications, however, were frequent and severe.

The following favorable signs appeared after the administration of the acid:—

1. A rapid cleaning of the tongue with the abolition of the characteristic unpleasant typhoid odor from the breath.

2. A sustained and remarkable lowering of the febrile temperature, with a well-marked morning remission in many cases.

3. Marked improvement in the unpleasant odor from the stools, which in a few days became practically deodorized.

4. Tympanites, diarrhœa, and delirium were rarely excessive and easily under control.

5. A most favorable convalescence with a sound recovery. R. C. Thacker (Brit. Med. Jour., Sept. 24, '98).

Septic disorders—as variola, septicæmia, puerperal fever, etc.—have been successfully treated with the sulphocarbates; the sulphocarbonate of zinc

may be given in doses of 2 or 3 grains four or five times daily.

Account of excellent results obtained in employment of carbolic acid internally in the treatment of small-pox in the Hospital Militar de Zaragoza is as follows: (1) the drug diminishes the temperature, which ascends again when the treatment is suspended; (2) it diminishes the number of cardiac pulsations, at the same time increasing their force; (3) it lessens the extension and duration of the eruption, checks the production of pus, and shortens the period of suppuration, especially when it is administered at the beginning of the disease; (4) in many cases the pustules of the confluent form become shriveled up and dry in a few days under the influence of the remedy; (5) in advanced cases it does not greatly modify the eruption, but will, nevertheless, influence favorably the fever and the general state of the patient; (6) the liability of complications is diminished. The results obtained seem to indicate that in the treatment of small-pox carbolic acid has as much value as quinine has for intermittent fever. The number of cases observed was 44,—18 of the discrete and 26 of the confluent form.

The mortality was 0.5 per cent. The acid was given in doses of from $15\frac{1}{2}$ to 31 grains in the course of the twenty-four hours, in solutions of the strength of $\frac{1}{2}$ per cent. Manuel Case y Abril (*Revista médico-farm. de Aragon*, Nov. 16, '91).

CUTANEOUS DISORDERS.—In parasitic skin diseases carbolic acid may be applied in $\frac{1}{2}$ - to 2-per-cent. solution: Scabies, favus, tinea tonsurans, tinea circinata, pityriasis versicolor, etc. In most of these diseases other remedies are preferable. In subacute eczema when there is a great amount of weeping and itching, a cerate of 10 grains of the acid to 1 ounce of simple cerate has been recommended.

Case of leucoderma treated by carbolic acid. There were numerous white patches, surrounded by zones of brown

pigmentation in the groins, on the abdomen, and the legs. Over the sacrum, the nape of the neck, and in the armpits were patches of brown discoloration only. Patches on nape of neck and sacrum were painted with pure phenol. Skin resumed its normal pink color after three weeks. Savill (*Brit. Jour. of Derm.*, Mar., '98).

A good dressing for burns consists of carbolic acid and carron-oil (4 grains of acid to each ounce of oil). B. F. Gardner applies the pure acid to burns and then cleanses with sterilized water.

Erysipelas has been treated by subcutaneous injections of a 2-per-cent. solution of carbolic acid. These have also been used in actinomycosis.

Good results obtained from carbolic acid especially in erysipelas, from the subcutaneous injection of a solution containing equal parts of glycerin and carbolic acid. A dose of $\frac{1}{8}$ grain is employed and has been found satisfactory as an analgesic and antithermic. Faivre (*La Sem. Méd.*, Aug. 17, '95).

An ointment containing carbolic acid and camphor has been used to mitigate the severe pruritus accompanying variola and to prevent pitting.

In two cases of variola, as soon as the papules developed into vesicles the surface was scrubbed with soap and water, followed by solution of hydrogen dioxide. The vesicles were then opened, the fluid allowed to escape, and the cavity touched with pure carbolic acid; the surface was again washed with solution of hydrogen dioxide, oiled, and covered with cloths wrung out of carbolized water. No pitting resulted. F. S. Purmann (*Med. Rec.*, Sept. 5, '96).

In many pruritic diseases, as papular eczema, psoriasis, lichen, and urticaria, or nettle-rash, J. V. Shoemaker advises: Carbolic acid, 5 to 10 drops; sublimed sulphur, $\frac{1}{2}$ drachm; camphor, 10 grains; zinc ointment, 1 ounce. This is to be applied frequently to the irritable surface.

Lotions containing carbolic acid allay the itching which accompanies jaundice. Hare recommends: Carbolic acid, 10 grains; olive-oil, 4 drachms. This to be applied frequently.

SURGICAL DISORDERS.—Carbolic-acid solution (1 to 20) has been used in surgery as an antiseptic lotion and also to keep instruments in while operating (corrosive sublimate and other antiseptics have almost entirely replaced it for the latter purpose).

For the dressing of wounds, carbolic acid has been used in the form of lotion, carbolized oil, gauze, and spray. As a local anæsthetic for minor operations (removing toe-nail, opening felon, incising carbuncle, etc.), it may be used by soaking the part for ten minutes in a strong solution, and afterward applying the pure acid on a brush to the line of incision.

Pure carbolic acid is an excellent application to carbuncles or malignant pustule after incision and curetting; it acts as an antiseptic and anæsthetic as well.

Four injections of a 2- to 3-per-cent. solution into the centre of a boil will usually bring about resolution. Leux (*Australian Med. Jour.*, Sept. 15, '89).

For urethral caruncle, injections of 20 drops of a mixture of equal parts of phenol and glycerol combined with 80 drops of water successfully employed. Webster (*Mass. Med. Jour.*, Mar., '94).

Camphorated phenol diluted with 50 per cent. of cotton-seed oil used with excellent results as a dressing for a severe case of ulcerating epithelioma of the leg. Toms (*Internat. Med. Annual*, '95).

Case of lupus erythematosus cured by continued use of undiluted carbolic acid, which was painted over the edges of the patches once or twice a week, and boric-acid ointment (20 grains to the ounce) applied daily, and especially after applying the acid. Minim doses of Pearson's solution of arsenic were also given with nux vomica and tincture of orange-peel.

Carbolic acid is the safest and most effectual form of caustic to use for patients with forms of lupus, etc., who are not under close observation. J. Hutchinson (*Arch. of Surg.*, Jan., '98).

S. Sherwell, of Brooklyn, treats nævi by tattooing them with needles dipped into a 50-per-cent. solution of the acid, afterward cleansing the surface with alcohol, and finally applying a layer of collodion. The results are said to be excellent, little or no scarring being left.

Non-suppurating enlarged glands may be treated by parenchymatous injections of 5 to 10 minims of a 2-per-cent. solution of carbolic acid. Buboes may be similarly injected with 10 minims of solution (8 grains to 1 ounce), first numbing the skin by an ether-spray. This treatment is also good in chronic synovitis (repeated every three days), and for boils and carbuncles if used early enough to abort the trouble.

For the cure of hydrocele, R. J. Levis advised injecting into the tunica vaginalis 15 to 20 minims of pure acid, after withdrawing the fluid.

Tetanus has been successfully treated by hypodermic injections of a 1-per-cent. solution of the acid, conjoined with warm baths and enemata containing chloral and potassium bromide.

By means of a series of subcutaneous injections of carbolic acid, hopeless case of tetanus was successfully treated. Patient was a man who had gunshot wound in his left leg, which was followed ten days later by tetanus, commencing in the muscles of the lower jaw and going on to general spasmodic contractions. After the tetanus had lasted for ten days subcutaneous injections of carbolic acid of the strength of 2 per cent. were tried, 12 drops being injected every three hours. After two days of this treatment a marked improvement manifested itself. Injections were continued until twenty-eight had been given, and a few days later the patient was discharged completely recovered. Osherov-

ski (Lancet; Indian Lancet, Nov. 16, '97).

DISINFECTANT.—As a disinfectant carbolic acid is only of moderate effectiveness; although a 2-per-cent. solution will kill most spores and germs, many resist, and even a 5-per-cent. solution requires more than twenty-four hours to kill the spores of anthrax. In all cases of disinfection by carbolic acid an exposure *by contact* of some duration is necessary. As an adjunct to other disinfection, the walls and floors of infected rooms may be scrubbed with a solution of carbolic acid, not weaker than 2 per cent. For the disinfection of wounds carbolic acid has been replaced by other remedies, which are as efficient and less harmful, as a deodorized carbolic acid is practically inert.

Study of relative value of disinfectants gives following results: 1. Alcohol in the absence of water neutralizes all bactericidal power on the part of mercuric chloride or phenol with regard to anthrax spores. The bactericidal action is not exercised until the dilution of the alcohol with water is greater than 2 per cent. in the case of 1 to 1000 sublimate solution, or than 70 per cent. in the case of phenol. 2. Glycerol interferes with the action of a 2 to 1000 solution of mercuric chloride if the proportion of water be less than 40 per cent. In the case of phenol it is still more manifest. 3. Phenol and lysol dissolved in olive-oil has no disinfecting action. Lenti (Ann. dell' Inst. d'Igiene sperim. della R. Univ. di Roma, vol. iii, fasc. 4).

Derivatives and Allied Compounds.—

ASEPTOL, OR SOZOLIC ACID.—This is a 33 $\frac{1}{3}$ -per-cent. solution of ortho-phenol-sulphonic acid. It occurs as a clear, yellowish-brown liquid; has the odor of carbolic acid; is soluble in alcohol, glycerin, and in all proportions in water; and possesses antiseptic properties. It is used as a disinfectant. It is claimed that it is free from all toxic effects, yet

more efficient than carbolic acid. It has been used externally in diseases of the bladder, eye, and skin, and in diphtheria, laryngitis, gingivitis, etc., in solutions of from 1 to 10 per cent. It should be kept from the light.

BROMPHENOL.—This is a fluid analogous to chlorphenol, bromine taking the place of chlorine. It has a purple color and has less of the carbolic odor than chlorphenol. Like chlorphenol, it is freely soluble in water, alcohol, and alkaline fluids. Like chlorphenol, in the form of a 2-per-cent. ointment it has given excellent results in erysipelas. (I. Tschourilow.)

BROMOL, TRIBROMOPHENOL, OR TRIBROMPHENOL.—This is obtained by the action between an aqueous solution of carbolic acid and bromine-water. It occurs in white crystals, of a disagreeable bromine odor, and has a sweet, astringent taste. It is insoluble in water, but soluble in alcohol, glycerin, ether, chloroform, and oils. It has been used in daily doses of 3 to 7 $\frac{1}{2}$ grains in cholera, typhoid fever, etc., and locally to purulent wounds in oily solution (1 to 30) or in ointment (1 to 8), and in diphtheria in 4-per-cent. solution in glycerin.

Bromol has given good results in diphtheria, in a glycerin solution of the strength of 1 in 25, locally applied. It may be also used in cholera infantum, in doses of from $\frac{1}{12}$ to $\frac{4}{17}$ grain. Rademaker (Lancet, Oct. 10, '91).

CHLORPHENOL.—This is a liquid obtained by the action of chlorine-gas upon carbolic acid. It is a mixture of chlorphenols, and is a dense volatile fluid of pleasant odor. It has been used in the treatment of tuberculosis, chronic bronchitis, bronchorrhœa and gangrene of the lung, ozæna, and laryngitis (Passerini), by inhalation, the daily dose being from 20 to 30 drops. It has also been

used locally on ulcers and in purulent otitis and abscess of the antrum of Highmore.

TRICHLORPHENOL, OR TRICHLOROPHENOL.—This is obtained from phenol by the action of chlorine. It occurs in white needles, soluble in alcohol and in ether, and slightly soluble in water. It is used locally in the treatment of diphtheritic ulcers, erysipelas, chancres, etc., in the form of a 5-per-cent. solution or ointment.

DIAPHTHERIN, OR OXYQUINASEPTOL.—This is a yellow, crystalline powder, soluble in water and dilute alcohol, and is a non-poisonous antiseptic. It is used in $\frac{1}{2}$ - to 2-per-cent. solutions for dressing wounds, ulcers, burns, etc., in external and median otitis and in eczema of the ear and nose. In solution it does not stain the hands, but it blackens steel instruments. This discoloration can be easily removed.

Diaphtherin possesses decided germicidal powers. A solution of the strength of 0.3 per cent. and one of 0.1 per cent. were sufficient to kill the staphylococcus pyogenes aureus in the course of fifteen minutes and forty-five minutes, respectively. Diaphtherin occurs in powdered form, very soluble in water. Solutions of 1-per-cent. strength have been employed with advantage in the treatment of wounds. It may also be used as a dusting-powder. The only disadvantage noticed so far is the staining of steel instruments occasioned by the drug. Kronacher (Münch. med. Woch., May 10, '92).

Diaphtherin as a germicide is much better than phenol and lysol in the form of a 2- or 3-per-cent. solution. Instruments that are not nickled are blackened by its use. It has an advantage over carbolic acid in that it is easily transported, either in the form of powder or tablets. It is chemically clean and its action easily controlled. It is not poisonous. A watery solution is perfectly clear, and there is no evaporation. Its use in surgery is recommended in

strengths of $\frac{1}{2}$ - to 2-per-cent. solutions. It is a most excellent dressing in cases of burns. There is never any irritation about the edges of wounds after its use, but occasionally patients complain of a slight burning sensation. The solutions do not affect the hands of the operator as do sublimate and carbolic solutions. Its greatest application is to be found in the treatment of nasal and aural troubles. Lembach and Schleicher (Corres. f. Schweizer Aerzte, Nov. 1, '92).

DIAPHTHOL, OR QUINASEPTOL.—This occurs in yellowish-white crystals, soluble in 35 parts of boiling water, and slightly soluble in cold water. It has antiseptic and antifermentative properties and is used in solution to disinfect the urinary tract. It prevents the decomposition of urine better than salol. It is slightly toxic, but does not give rise to gastric or intestinal irritation. Diaphthol is eliminated unchanged by the kidneys.

PHENOSALYL.—This is a mixture of carbolic acid, 90 parts; salicylic acid, 10 parts; lactic acid, 20 parts; and menthol, 1 part, mixed with heat. It has been used externally in solution, in conjunctivitis (in 0.2 to 0.4 per cent.), in eczema (in 1 per cent.), and in purulent cystitis (in 2 per cent.).

Phenosalyl possesses antiseptic powers superior to the antiseptics usually employed, with the exception of corrosive sublimate. A solution of 1 per cent. suffices to kill the most resisting microbes in one minute. It has the great advantage of being non-toxic, experiments showing it to be four times less so than carbolic acid and a hundred times less than corrosive sublimate.

Clinical experiments with the drug were made at the Hôtel-Dieu, in Paris, in the service of Cornil, upon more than one hundred patients, mostly affected with genito-urinary troubles, as endometritis, erosions of the cervix, vaginitis, and urethritis. In every case, even inveterate ones, its use was followed by rapid recovery. In several cases of puerperal infection it caused the fever and

other symptoms rapidly to disappear. For surgical use, injections, irrigations, etc., phenosalyl is employed in aqueous solutions of from $\frac{1}{2}$ to 1 per cent. This does not injure the instruments nor irritate the skin. It may easily be used for antiseptic gauze and cotton, and for the preservation of silk and hair, sponges, etc. Duloir (Thèse de la Faculté de Paris, '93).

SAPROL.—This is a mixture of coal-tar constituents, proposed as a cheap disinfectant. It occurs as a dark-brown, oily fluid. When added to water it floats. In 1-per-cent. solution it is well adapted for the disinfection of dejecta in barracks, prisons, and schools.

Of all disinfectants advocated for rendering infected stools and cess-pools innocuous, saprol most nearly answers all requirements. It forms no inefficacious compound on admixture, and readily diffuses itself among the excreta. Scheurlen (Archiv f. Hyg., B. 4, '93).

TRIKRESOL, or tricresol, is a mixture of ortho-, meta-, and para- cresols from coal-tar. It is a colorless, oily liquid, soluble in about 40 parts of water. It is a germicide and antiseptic, and does not attack instruments or benumb the hands. It is much less irritant and less poisonous than carbolic acid or bichloride of mercury. In 1-per-cent. solution or ointment it is used in skin diseases and for surgical dressings. In weak solution (1 to 500 or 1000) it has been found useful as an antiseptic collyrium in ophthalmic practice.

SULPHOCARBOLATES.—The sulphocarbates of sodium and zinc are largely employed as mild, local stimulants on ulcers or open wounds, in powder or in solution. They are more commonly given internally, as gastro-intestinal antiseptics, in foetid diarrhoea and in typhoid fever, in dose of 2 or 3 grains in pill, four or five times daily, the zinc salt being mostly used. They are probably voided by the intestines unchanged.

Magnesium sulphocarbonate is proposed as an efficacious laxative and intestinal antiseptic in doses of 15 to 30 grains (F. Tarozzi).

[Other preparations of phenol may be found under CREASOTE, volume ii.]

C. SUMNER WITHERSTINE,
Philadelphia.

PHENOCOLL.—Phenocoll, or amido-aceto-phenetidin, is a derivative of phenacetin, produced by the action of glycoll, which is an amido-acetic acid, upon phenacetin. It occurs in white, matted needles, soluble in alcohol and slightly soluble in water. Several salts of phenocoll are in use, the hydrochlorate, salicylate, acetate, and carbonate. The hydrochlorate is most frequently used; it occurs in colorless needles or as a white powder, having a salty taste, with a sweetish after-taste and an aromatic odor, and is soluble in 16 parts of water, forming a neutral solution. It is incompatible with the alkalies. Its chief use is as an antipyretic, although it is also an antirheumatic, analgesic, and diaphoretic. It is best given in powder, as the aqueous solution, neutral at first, develops an alkaline reaction after two days.

Phenocoll salicylate, or salocoll, occurs in fine needles having a sweetish taste, and is soluble in hot water. It has antipyretic, antiseptic, and analgesic properties.

The acetate (soluble in $3\frac{1}{2}$ parts of water) and carbonate have also been prepared.

Dose.—Any of these preparations may be given in doses of from 10 to 15 grains. The maximum daily dose is 75 grains.

Salocoll is well borne by the stomach; does not produce pain in the stomach, modification of the blood-pressure, or cyanosis; and has, apparently, no de-

pressant effect upon the heart. It is used in the same dose and for the same purposes as phenocoll.

Physiological Action.—Phenocoll is rapidly eliminated; it may be found sometimes as soon as an hour after ingestion in the urine, and gives it a reddish-brown color. Balzer ascribed to phenocoll the power of markedly increasing nitrogenous elimination; but this is doubtful. Ott found that it produced paralysis of both motor and sensory functions of the spinal cord, death being due to diastolic arrest of cardiac action. Cerna and Carter, in a series of careful experiments, thus summarized the physiological effects of this drug: 1. Phenocoll, in ordinary amounts, has practically no effect upon the circulation. 2. Large doses diminish the blood-pressure by influencing the heart. 3. Phenocoll reduces the pulse-rate by stimulating the cardio-inhibitory centres. It then increases the rapidity of the pulse by paralyzing said centres. The final diminution is of cardiac origin. 4. Upon the blood itself phenocoll has no action.

Therapeutics.—Phenocoll has been given in fevers in the same manner as phenacetin; but, like phenacetin, it is contra-indicated in advanced exhausting diseases. Cerna and Carter have shown that the very decided fall of temperature, which occurs the first hour after the administration of the drug by the stomach, is the result of an enormous diminution of heat-production, without any alteration of heat-dissipation; hence great care should be exercised in all diseases in which the vital powers are low. If too much diaphoresis is induced it may be controlled by the use of atropine. Phenocoll has been found useful in acute rheumatism and in neuralgias of various kinds.

Hydrochloride of phenocoll exerts a marked antithermic action in a period of time varying from half an hour to six hours. It is an excellent antiseptic, and a most useful antipyretic and analgesic in even the most severe and varied forms of neuralgia.

The use of increasing doses is not necessary. In grave conditions and in young children this drug does not produce nausea, vomiting, collapse, or any other disturbance. It lowers the temperature in a regular and continuous manner, often producing slight cutaneous transpiration, more rarely sweating. It acts not only on the great nervous centres, the cerebellum and spinal cord, but also on their peripheral ramifications, producing a slight warmth in the head and flushing of the face. It determines, although not constantly, varying degrees of dilatation of the pupil, especially in somewhat large doses, the mydriasis persisting even after all other characteristic symptoms of phenocoll have disappeared. Villani (*Gaz. Med. Lombarda*, Dec. 19, '98).

In malarial fevers 15 grains are given from two to six hours before the expected paroxysm. Phenocoll has no unpleasant after-effects and its taste may be disguised by mixing it with sugar. It may be combined with quinine. G. Cucco (*Therap. Monats.*, Apr., '93).

Phenocoll tried in 34 cases of malaria, with a permanent cure in 24, doubtful results in 5, and failure in the other 5. Some of the patients cured suffered severe relapses after treatment with quinine. To prevent relapses, phenocoll was given in 15-grain doses, in powder, six or seven hours before the expected paroxysms. The taste is easily covered by mixing it with sugar. Albertoni (*Riforma Medica*, Feb. 5, '92).

Phenocoll prescribed in 100 cases of intermittent fever rebellious to quinine. In 50 per cent. of the cases there was a cessation of the fever and no disagreeable after-effects. It is superior to all other remedies proposed for malaria. Pallettini (*Gaz. degli Osp.*, Jan. 14, '93).

Following conclusions reached regard-

ing hydrochloride of phenocoll: 1. Hydrochloride of phenocoll is an excellent antipyretic, analgesic, and anti-rheumatic medicament. 2. It renders remarkable services in the treatment of malarial fevers, even in long-standing cases which have been rebellious to the salts of quinine, and it reduces the size of the spleen in malarial disease. 3. It is employed with advantage in chorea and in whooping-cough and as an antithermic in the different febrile diseases. 4. It is easily administered even to the most delicate children, and it is well tolerated by them as well as by adults. Dall' Ilio (Gaz. med. Lombarda, p. 34, '98).

INFLUENZA.—Hydrochloride of phenocoll has recently been recommended by Giovanni Villani (Gaz. med. Lombarda, Dec. 19, '98) as a very valuable remedy for the treatment of influenza, the author having personally used it in upward of 400 cases. The amount used was from 30 to 45 grains daily, administered in powders of $7\frac{1}{2}$ grains each for adults, and, for children, from 15 to $22\frac{1}{2}$ grains in solution in the course of twenty-four hours.

PERTUSSIS.—Phenocoll hydrochlorate successfully used in 42 cases of pertussis by Vargas (Ther. Woch., Jan. 5, '96). The dose was from 1 to 30 grains daily, given usually in mucilage or in water, in which it is soluble in the proportion of 1 to 7. In all of the cases treated the good results were noticeable within twelve hours, but in some cases the number of paroxysms was reduced only on the following day.

AS DRESSING.—Carl Beck, of New York, has used phenocoll externally as a dressing for accidental and surgical wounds, and for inflamed and suppurating cases. He uses a 10-per-cent. gauze, a 5-per-cent. watery solution, and a 10- or 15-per-cent. alcoholic solution. As a dressing for burns and ulcers, a 10- or 20-per-cent. ointment may be used, but

the gauze gives better results. Phenocoll is inodorous and devoid of all irritating properties.

PHOSPHATURIA.

Definition.—The daily amount of phosphoric acid excreted with the urine amounts to 2 or 3 grammes; it is then combined with soda, potash, lime, and magnesia. Phosphaturia occurs when, soon after evacuation, a sediment is formed consisting of phosphates of lime and magnesia. In some cases the urine is already turbid when evacuated.

Etiology and Pathology.—Phosphaturia is sometimes observed during the course of diabetes. As it was formerly ascribed to defective metabolism, it was believed to be the cause of many nervous symptoms. This view, however, has recently been doubted by many authors. Phosphaturia is not necessarily due to an excessive formation and excretion of phosphoric acid, but is caused by a diminution of the acidity of the urine, such as that observed in neurasthenic individuals. In some cases it is due to the composition of the food; in other cases, perhaps, to an abnormal acidity of the gastric juice.

Treatment.—Phosphaturia *per se* does not need any special treatment, and will ordinarily cease when the alimentation is properly regulated.

Following method recommended for separating the alkaline and earthy phosphates of urine: 30 cubic centimetres (1 fluidounce) of urine and 30 cubic centimetres (1 fluidounce) of a 5-per-cent. solution of caustic soda are mixed and allowed to stand for twenty-four hours, when 30 cubic centimetres (1 fluidounce) of the clear liquid remaining is poured out, free from earthy phosphates. To this is added 2 cubic centimetres (31 minims) of a 30-per-cent. solution of acetic acid to neutralize the soda and 5 cubic centimetres ($1\frac{1}{4}$ fluidrachms) of a solution of acetic acetate

(50 grammes—1½ ounces—of acetate of sodium, 50 grammes—1½ ounces—of acetic acid, water to make 1 litre—quart) heated to 60° C. (140° F.) and titrated with uranium. For the balance of the liquid, 2 cubic centimetres (31 minims) of acetic-acid solution and 5 cubic centimetres (1¼ fluidrachms) of acetic acetate are also used to dissolve the earthy phosphates and place it in identical conditions of acidity for titration. Richard (Jour. de Méd., de Chir., et de Pharm., Nov. 11, '93).

Certain albuminurias connected with functional disturbances of nutrition, which may be cured or may end in a renal lesion, are separated from Bright's disease. Its characteristic is organic demineralization. This phosphaturic albuminuria comprises four varieties: (a) simple phosphaturic albuminuria, confounded with cyclical, or intermittent, albuminuria; (b) pseudoneurasthenic phosphaturic albuminuria; (c) *pseudo-brightique* or *prébrightique* phosphaturia, confounded with interstitial nephritis; (d) albuminuria of Bright's disease of phosphaturic origin. A. Robin (Bull. de l'Acad. de Méd. de Paris, Dec. 19, '94).

Phosphaturia is met with: 1. In cases where there is digestive or nervous disturbance, the phosphatic urine indicating a diminution of the acidity; though this may be called phcsphaturia from a chemical stand-point, the term is not precise clinically. 2. In severer and long-continued cases, corresponding to phosphaturic diabetes insipidus. Here also there are no definite clinical conditions. Thorndike (Boston Med. and Surg. Jour., Feb. 8, '94).

F. LEVISON,
Copenhagen.

PHOSPHORIC AND HYPOPHOSPHOROUS ACIDS.—

Phosphoric acid as used in medicine is orthophosphoric acid. The official acid is a colorless, syrupy liquid, without odor, having an intensely-acid taste. It should not contain less than 85 per cent. absolute orthophosphoric acid. It is soluble in all proportions in water and in alcohol.

When heated above 392° F. it changes into pyrophosphoric acid. Dilute phosphoric acid should contain 10 per cent. of absolute acid.

Hypophosphorous acid is a clear, colorless, and odorless, sour liquid, miscible in all proportions with water, and is decomposed at high temperatures. The pure acid is not official. Dilute hypophosphorous acid should contain 10 per cent. of absolute acid.

Preparations and Doses.—Acidum hypophosphorosum dilutum (U. S. P.), 10 to 60 minims.

Acidum phosphoricum (U. S. P.), 3 to 7 minims.

Acidum phosphoricum dilutum (U. S. P.), 10 to 60 minims.

Physiological Action.—Pure phosphoric acid is a local irritant and escharotic. When taken internally well diluted, it stimulates the stomach and aids digestion. It stimulates the appetite, increases the salivary secretion, and acts as a general tonic. In large doses it acidifies the urine. Hypophosphorous acid is stimulant and tonic in its action.

Therapeutics.—The dilute acids in doses of 20 to 60 drops are useful as tonic and gastric stimulants. They are useful in nervous exhaustion in that they aid digestion by stimulating the stomach. In all debilitated conditions, as anæmia, the exhaustion of prolonged lactation, and in bronchial catarrh of the aged they are useful. Like the mineral acids, they should be given before meals in hyperacidity of the stomach. Phosphoric acid may be preferred to the mineral acids in typhoid fever when nervous prostration is a prominent symptom. The dilute acid may be used as a stimulant to indolent ulcers.

PHOSPHORUS.—Phosphorus is a non-metallic element. In the state of combined phosphoric acid it is contained

in the ancient unstratified rock and in the lavas of modern times. As these disintegrate and crumble down into the fertile soil, the phosphates pass into the plants and ultimately as food into the bodies of man and animals. The earthy phosphates communicate rigidity to the bony skeleton.

Phosphorus was discovered in 1669 by Brandt, of Hamburg, who obtained it from urine. It is now obtained from bones. When pure, phosphorus very much resembles imperfectly bleached wax and is soft and flexible at common temperatures. It occurs in yellowish, semitransparent sticks, which have a waxy lustre when cut. It is luminous in the dark and when exposed to the air. It is soluble in chloroform, carbon disulphide, oils, 80 parts of ether, and in 350 parts of absolute alcohol.

Preparations and Doses.—Phosphorus (U. S. P.), $\frac{1}{100}$ to $\frac{1}{20}$ grain.

Elixir phosphori, U. S. P. (phosphorus, 0.025 per cent.), $\frac{1}{2}$ to 2 drachms.

Oleum phosphoratum, U. S. P. (phosphorus, 1 per cent.), 1 to 5 minims.

Pilulæ phosphori, U. S. P. (phosphorus, $\frac{1}{100}$ grain), 1 to 2 pills.

Spiritus phosphori, U. S. P. (phosphorus, 0.12 per cent.), 1 to 5 minims.

Liquor phosphori (Thompson's solution: $\frac{1}{20}$ grain of phosphorus in each drachm), $\frac{1}{4}$ to 1 drachm.

Calcii hypophosphis (U. S. P.), 5 to 30 grains.

Calcii phosphas præcipitatus (U. S. P.), 5 to 30 grains.

Ferri hypophosphis (U. S. P.), 5 to 10 grains.

Ferri pyrophosphas solubilis (U. S. P.), 2 to 5 grains.

Potassii hypophosphis (U. S. P.), 5 to 30 grains.

Sodii hypophosphis (U. S. P.), 5 to 20 grains.

Sodii phosphas (U. S. P.), 1 to 8 drachms.

Sodii pyrophosphas (U. S. P.), 2 to 20 grains.

Zinci phosphidum (U. S. P.), $\frac{1}{16}$ to $\frac{1}{3}$ grain.

Syrupus calcii lactophosphatis (U. S. P.), 1 to 2 drachms.

Syrupus ferri, quininæ et strychninæ phosphatum, $\frac{1}{2}$ to 1 drachm.

Syrupus hypophosphitum (lime-salt, 4.5 per cent.; soda and potash salt, each, 1.5 per cent.), 1 to 2 drachms.

Syrupus hypophosphitum cum ferro (1 per cent. ferrous lactate and potassium citrate), $\frac{1}{2}$ to 1 $\frac{1}{2}$ drachms.

Physiological Action.—Phosphorus being a constituent of most tissues, it exerts a stimulating influence, when administered in small doses, upon their nutrition. This is particularly marked as regards the nervous and osseous systems. When, however, it is administered in toxic doses, it gives rise to changes in the metabolism which Münzer (Deut. Archiv f. klin. Med., B. 52, H. 3, 4, '94) summarizes as follows, after an analysis of 15 cases of acute poisoning: During the first two or three days after the poison is swallowed there is a marked diminution in the total amount of nitrogen present in the urine, attributed not to the specific action of the phosphorus, but to the persistent vomiting and consequent state of starvation. On the second or third day after the poison is taken a marked increase in the excretion of nitrogen takes place, attributable to excessive destruction of tissue-proteids caused by the phosphorus. Usually death quickly occurs as soon as the amount of nitrogen has become very great; but in many cases there is a dim-

inution both in nitrogen and of the quantity of urine excreted during the last hours of life. As regards the percentage of urea, if it is below 85 to 90 per cent. of the total amount of nitrogen excreted, disease of the liver, of such a kind as to interfere with its urea-forming function, is thereby indicated, the absent urea being replaced by excess of ammonia, which ought to have been converted into urea. But in some of the cases observed the quantity of urea excreted, after having been reduced very low, was subsequently increased three-fold, although the condition of the liver was progressively becoming worse. The view taken is that the excess of ammonia is solely due to development of acid products in the tissues, caused by the toxic action of the phosphorus, and not to arrest of the urea-forming function of the liver. In addition to the increase in ammonia there is excess of uric acid excreted in cases of acute phosphorus poisoning during the stage of rapid proteid metabolism, and also of nitrogenous extractives. Münzer failed, with one exception, to find peptones in the urine.

The chlorides of the urine are rapidly diminished after the acute toxic effects of phosphorus develop. The excretion of phosphoric acid is increased during the first few days; afterward it progressively diminishes until death.

The excretion of sulphuric acid, upon the whole, runs the same course as that of phosphoric acid; ether sulphates are increased. No fatty acids—tyrosin, leucin—nor sarcolactic acid were found, nor any diamines. Chemical analysis of the brain-substance showed an increased percentage, and of the liver a decreased percentage, of phosphoric acid.

While phosphoretted hydrogen gives rise to the same toxic effects as those of phosphorus, red phosphorus is not

poisonous; consequently the cause of the toxic quality of white phosphorus must lie in the production of phosphoretted hydrogen when in contact with living tissues. In other words, when white phosphorus is introduced into the digestive tract phosphoretted hydrogen is given off, which, being easily absorbed, passes into the blood and gives rise to disturbances which prevent hæmätosis. This pathogenesis being granted, a new method of treatment is to be followed, which consists in acting against the formation and absorption of phosphoretted hydrogen. J. Noe (*Le Bull. Méd.*, Apr. 21, '95).

The physiological action of phosphorus in chronic poisoning was outlined in the section on diseases of the jaws (NECROSIS, PATHOLOGY).

Experiments conducted upon dogs who were poisoned by gradually increasing doses of phosphorus, given hypodermically in oil. Immediately after death the nervous tissues were fixed in corrosive-sublimate solutions and stained by Nissl's methods and its modifications and with Biondi-Heidenhain solutions.

In three dogs poisoned by phosphorus varied and diffuse changes of the cellular elements of the nervous system and of their elementary constituents were found. The changes in the spinal cord increased gradually from the anterior to the posterior roots.

The anatomo-pathological process consisted in a primary degeneration of the cortico-medullary cells, of those of the cerebellum and of the spinal ganglia with a varying amount of participation of the chromophilic substance of the dendrites. No changes were observed in the neuroglia nor in the blood-vessels. Enrico Rossi (*Riv. di Patol. Nerv. e Ment.*, vol. ii, p. 535, '98).

Poisoning by Phosphorus.—Poisoning by phosphorus may be acute or chronic.

ACUTE POISONING may occur from an overdose of any preparation of unoxidized phosphorus, or from swallowing phosphorus paste used for destroying vermin, or from chewing the tops of lucifer matches. Red phosphorus, an

allotropic form made by heating (464° to 482° F.) phosphorus for fifty hours in an atmosphere which is unable to act upon it chemically, is not poisonous, and has replaced to a large extent the yellow variety in the manufacture of matches. In acute poisoning the rapidity with which the symptoms appear varies. Generally in from one to eight or ten hours the peculiar, disagreeable taste of phosphorus is noticed in the mouth and the breath is heavily laden with its odor. An intense warmth in the œsophagus, stomach, and bowels develops gradually into a violent, burning pain, which extends all over the abdomen. Eructations having a garlicky odor, followed by nausea, vomiting, and purging now follow. The vomited matters at first consist of food and later of mucus, bile, and, perhaps, blood; the color of the vomited matter is usually dark, the odor of phosphorus is present, and it with the dejecta may be luminous in the dark, owing to the presence of phosphorus. The pupils are dilated, the abdomen distended, the extremities cold, the pulse weak, and the thirst intense. Constipation is sometimes present instead of purging. Very soon the liver increases in size and is the seat of pain and tenderness. After twenty-four or forty-eight hours the symptoms abate and symptoms of acute yellow atrophy of the liver develop. Jaundice appears, first in the conjunctivæ, and then extends over the whole body. Vomiting and pain now return, "coffee-ground" matter is vomited, showing the presence of altered blood. The bowels are now confined, or, if moved, the stools are clay-colored, showing the absence of bile. Bile is also absent from the vomited matter. The urine is often retained. Nervous symptoms develop—muscular twitching, headache, vertigo, delirium,

and convulsions, or coma—and death ensues. If the patient survive the acute stage, he generally dies of general fatty degeneration of the internal organs. Recovery is rare.

The smallest doses of phosphorus known to have destroyed life were $1\frac{1}{2}$ grains in a man, $\frac{1}{8}$ grain in a woman, and $\frac{1}{50}$ grain in a child. Death in cases of acute poisoning usually takes place within three to six days. In one recorded case death occurred in half an hour. Chronic cases may last for months or even years.

CHRONIC POISONING may result from exposure to phosphorus-fumes in match- and other factories or from the long-continued use of large doses of the drug: The most common symptoms of chronic poisoning by phosphorus are fatigue, abdominal pains, anorexia, dyspepsia, diarrhœa, sometimes obstinate constipation, intermittent headache, more or less cough, and necrosis of the lower jaw, if the teeth are carious, attended by swelling and distension of the gums with pus (see JAWS, DISEASES OF). The complexion becomes sallow. The skin may be the seat of an eruption. The hair falls out. There is an increase of phosphates in the urine.

Treatment of Poisoning by Phosphorus.

—The researches of E. Q. Thornton, of Philadelphia (Ther. Gaz., Jan., '93), have developed the fact that the use of sulphate of copper as an antidote is dangerous, and that the best antidotes are the permanganate of potash and hydrogen peroxide, which act chemically by oxidizing the phosphorus and thus destroying its poisonous character. Thornton prefers potassium permanganate because peroxide of hydrogen is too slow in its action. The permanganate is used in a $\frac{1}{2}$ - to a 1-per-cent. solution by mouth, or a 1 to 1000 solution may

be used to wash out the stomach. A pint of this latter solution has been used with success half an hour after the poison was taken.

Potassium permanganate is the best antidote for phosphorus. Administration of the potassium salt advised before the phosphorus becomes absorbed, since vomiting will generally prevent the chemical reaction. The antidote must be well diluted (0.5- to 1-per-cent. solution), and must be given in excess, from the fact that a large portion of the permanganate is reduced by the organic substances of the stomach. E. Q. Thornton (Ther. Gaz., Jan., '93).

Potassium permanganate has been proposed as an antidote for these poisons, the effect depending upon the powerful oxidizing action of the salt. Since large doses of potassium salts are toxic, the remedy cannot always be used in sufficient quantity, and for this reason sodium permanganate substituted. Experiments with animals show this to be as effective as the potassium salt, and applicable without danger in larger doses. In cases of poisoning by phosphorus irrigation of the stomach with 0.2-per-cent. solution, leaving a pint of the solution in the stomach, advised. Schreiber (Apoth. Zeit.; Alienist and Neurol., July, 1901).

Oils must be avoided in all cases, as phosphorus dissolves in them and thus absorption is favored. The value of old turpentine (French turpentine) should not be forgotten, used preferably after an emetic (cupric sulphate, 3 grains well diluted, repeated every five minutes until vomiting occurs).

The administration of magnesia or sulphate of magnesia is desirable, to empty the bowels and promote elimination. Further treatment will be directed by the symptoms present; stimulants and anodynes are usually indicated.

In chronic poisoning immediate withdrawal from the infected atmosphere is demanded. The teeth and gums of those working in the presence of phos-

phorus-fumes should be carefully looked after, and kept in good order.

Therapeutics.—Certain precautions should be taken during the period of medication by phosphorus. Frequent observation of the patient is not only desirable, but necessary, for the prompt detection and relief of the first symptoms of overeffect; phosphorus should never be given long in large doses; phosphorus is not indicated in diseases attended by acute or inflammatory lesions; phosphorus should never be given in substance, but in the form of an alcoholic or oily solution. Phosphorus is chiefly indicated in malnutrition of nerve and bone.

Substances containing phosphorus (glycerophosphates, lecithins, phosphoric acid) fix phosphorus in the organism and stimulate multiplication of cellular elements: *i.e.*, the enlargement and division of nuclei and changes in multiplication. They produce a general dynamogenic action. Phosphoric acid is anti-alkaline, antiseptic, and assists digestion. A. Martinet (La Presse Méd., No. 44, 1901).

The author states that anhydrous phosphoric acid has no toxic action. Guinea-pigs killed after having ingested what would be equivalent to doses of 200 grammes a day for a man, showed no evidences of fatty degeneration of the kidneys or liver. The microscopic findings were those of normal organs, as also in dogs. Some of his patients have been taking from 2 to 4 grammes for more than five years, without showing evidences of intolerance. The morbid conditions in which it is most beneficial are those in which there is demineralization of the organism with hypoauidity of the urine. It is especially effectual when the nervous system seems to have partially lost its resisting power. True neurasthenia, for instance, is accompanied by considerable elimination of the alkaline phosphates in the urine, the logical consequence of the exaggerated consumption of phos-

phoric acid occasioned by the overexertion of the brain. The nervous balance cannot be restored until the lost phosphorus has been replaced. In neurasthenics in whom the nerve cells are secondarily affected from some digestive or other trouble, the urine will be found hypoacid with phosphaturia or "hypophosphata," and the phosphoric acid may be required for years. In arthritis, rheumatism, tuberculosis, malaria, dyspepsia etc., during the phases accompanied by demineralization of the organism, phosphoric acid will be found surprisingly effective, as also in the nervous troubles of pregnancy and over-rapid growth. Years of experience have only rendered the author more emphatic in the recommendation of phosphoric acid in therapeutics. F. Cautra (*Presse Médicale*, No. 74; from *Journal of the American Medical Association*, Nov. 12, 1904).

OSSEOUS DISORDERS.—The beneficial action of phosphorus in certain diseases of the bones is acknowledged. In rachitis and osteomalacia phosphorus is perhaps best combined with codliver-oil or lipanin (an artificial mixture devised by von Mering, as a substitute for codliver-oil, consisting of 6 parts of oleic acid to each 100 parts of olive-oil, and being free from disagreeable odor and taste, readily emulsified, and easily digested): phosphorated oil, 16 minims; codliver-oil, 4 ounces. A teaspoonful four times daily. Kassowitz suggests: Phosphorus, $\frac{1}{6}$ grain; saccharin, 72 grains; essence of lemon, 2 minims; codliver-oil, 3 $\frac{1}{2}$ ounces. A teaspoonful three times daily. J. Comby gives the following modification of Trousseau's formula: Phosphorus, $\frac{1}{7}$ grain; iodide of potash, 4 grains; bromide of potash, 15 grains; table-salt, 2 drachms; fresh butter, 17 $\frac{1}{2}$ ounces. Of this mixture about $\frac{1}{3}$ ounce is given daily, spread upon bread.

NERVOUS DISORDERS.—Phosphorus is a valuable tonic and restorative in neu-

rasthenia, or nervous debility, when the system is weakened by anxiety, overwork, or sexual excesses. It is also a valuable tonic in the neuralgia of the asthenic type, but has little influence over pain. It is frequently given with good result in herpes zoster. In the weakened conditions following acute and chronic alcoholism and morphinomania good effects may be obtained from the administration of phosphorus. Phosphorus will support the system when exposed to severe and prolonged mental and physical strain. In cerebral atony and mental enfeeblement, even if symptomatic of organic brain-lesion, phosphorus will yield good results; indeed, it is not useless in cerebral softening, cerebral endarteritis, and paralysis of cerebral origin, and meningitis of a chronic type.

Insomnia, when due to cerebral anæmia and malnutrition, has often been removed by phosphorus. Mania and paralysis agitans may be relieved, and in some cases of locomotor ataxia and spinal sclerosis improvement has followed medication by this drug. In functional impotence or sexual exhaustion the influence of phosphorus is marked.

DISORDERS OF THE BLOOD AND VASCULAR ORGANS.—Phosphorus is not infrequently beneficial in the treatment of angina pectoris.

In anæmia small doses of phosphorus, in conjunction with iron, will yield good results. In pernicious anæmia small doses of phosphorus seem to check the progress of the disease. In small doses, continued over long periods, it will arrest fatty degeneration of the heart and ameliorate the symptoms due to it. Atheroma of the vessels is amenable to the influences of phosphorus.

FEBRILE DISORDERS.—Phosphorus will be found of use as a restorative after

typhoid fever and typhoid pneumonia, especially if the nervous system be particularly affected in prolonged cases; it hastens convalescence and repairs the shattered forces of the patient. Phosphorated oil is said to be valuable in intermittent fever, and also in the eruptive fevers (measles, scarlatina, etc.) when the rash recedes or does not come out promptly. In the third stage of pneumonia phosphorus is said to aid resolution.

CUTANEOUS DISORDERS.—In skin diseases phosphorus may often be substituted for arsenic, with advantage. In boils and carbuncles, in acne indurata or inveterata, in psoriasis, and in eczema of nervous origin calcium phosphate or the alkaline hypophosphites are valuable. In lupus erythematosus, L. D. Bulkley, of New York, has found phosphorus invaluable. He uses Thompson's solution, as it causes less gastric and hepatic disturbance than the oily solutions or pills. (Thompson's solution of phosphorus is made by dissolving 1 grain of phosphorus in 5 drachms of absolute alcohol with gentle heat, and adding a warmed mixture of $1\frac{1}{2}$ ounces of glycerin, 2 drachms of alcohol, and 40 minims of spirit of peppermint; one drachm of this solution contains $\frac{1}{20}$ grain of phosphorus.) He begins with 15 minims of the solution, quickly added to water and quickly taken, after meals thrice daily. The dose is gradually increased until 40 to 45 drops are taken; exceptionally, the dose may be increased to 60 drops. If gastric disturbance appear, it should be attended to and the drug stopped. If constipation be present, a pill of blue mass, colocynth, and ipecac is indicated. When the gastric functions are restored, the use of phosphorus should be resumed. The treatment may be continued, with careful

watching, for months, in this malady, and great benefit may be expected.

Hyperidrosis due to nervous debility is checked by phosphorus.

Therapeutics of the Phosphates and Hypophosphites.—The hypophosphite of calcium and the precipitated phosphate of calcium are of value in the treatment of scrofulosis, struma, and rachitis. The hypophosphites and lactophosphites are found useful in rickets and in slow and delayed union of fractured bones. In dental caries and anæmia of nursing women, in general debility and nervous prostration, and in hepatic torpor they will do good.

The lactophosphates and hypophosphites are simply convenient modes of administering calcium, potassium, and other substances, while phosphorus acts as a stimulant to bone-growth and not by its deposition in the bone; this difference between these salts and phosphorus should be clearly borne in mind. (Hare.)

Phosphate of sodium is considered by Bartholow the best remedy in hepatic cirrhosis and jaundice, in doses of 20 grains to 2 drachms, in single dose or repeated several times a day, according to the laxative effect desired. Hare recommends phosphate of sodium for bottle-fed children, who continually alternate between diarrhoea and constipation, added in doses of 2 to 4 grains to each bottle of milk.

The hypophosphites have been largely used in the treatment of incipient phthisis. R. W. Gardner, of New York, has followed out the suggestions of Churchill, in the preparation of various syrups of the single hypophosphites. Churchill advises against a combination of different hypophosphites because the different bases are indicated in different stages of the disease: Soda in the incipient stage; lime in the second and

third stages; quinine hypophosphite in the initial treatment of far advanced cases, to be followed by lime or soda later on; lime reduces expectoration; soda favors expectoration; the tendency of the hypophosphites is to create plethora; therefore discrimination in dosage is necessary, when there is any tendency to pulmonary hæmorrhage.

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PHTHISIS. See TUBERCULOSIS.

PHYSOSTIGMA.—Physostigma (U. S. P.), Calabar bean, or Ordeal bean of old Calabar, is the seed of *Physostigma venenosum* (nat. ord., *Leguminosæ*): a woody creeper indigenous to western Africa along the River Niger. It contains the alkaloids physostigmine (also called eserine), eseridine, and calabarine, physosterin (a substance related to cholesterolin), starchy matters, oils, etc.

Physostigmine occurs in colorless, very hygroscopical crystals, readily altering to a resin-like mass. It is soluble in alcohol, ether, and chloroform and sparingly soluble in water. It forms salts with the acids, which vary in solubility; the salicylate and sulphate are official.

Physostigmine salicylate occurs in colorless or slightly-yellowish, lustrous crystals, soluble in 150 parts of water. This salt is least affected by the light, but must be kept dry. Solutions of this salt deteriorate on standing and become brownish-red in color when spoiled for use; when freshly made, they are of a faint-pink color.

Physostigmine sulphate occurs as a white or slightly-yellowish, deliquescent, crystalline powder, of bitter taste. It is freely soluble in water and alcohol. This salt should be kept dry and away from the light.

Eseridine occurs in white, four-sided crystals, soluble in alcohol, ether, and chloroform. Eseridine is a laxative and motor-excitant. It is one-sixth as powerful as physostigmine.

Calabarine is said to act much like strychnine.

Preparations and Doses.—Physostigma, U. S. P. (Calabar bean), $\frac{1}{2}$ to 2 grains.

Extractum physostigmatis, U. S. P. (alcoholic extract), $\frac{1}{10}$ to $\frac{1}{2}$ grain.

Tinctura physostigmatis, U. S. P. (15-per-cent. strength), 5 to 10 minims.

Physostigminæ salicylas (U. S. P.), $\frac{1}{100}$ to $\frac{1}{30}$ grain.

Physostigminæ sulphas (U. S. P.), $\frac{1}{100}$ to $\frac{1}{60}$ grain.

Physiological Action.—The physiological action of Calabar bean has been studied by a large number of observers, a summary of whose labors tends to demonstrate that the main effects of the drug are exercised upon the motor centres of the spinal cord. This action involves depression of the respiratory centres of the medulla, and, by reflex action, an increasing paralysis leading to paralytic asphyxia. The cerebral cortex, the sensory nerves, and the sensory nerve-centres suffer no loss of function, while the motor nerve-trunks are scarcely involved under normal circumstances. Poisonous doses, however, may cause all these structures to be more or less affected. Wood concludes that "Calabar bean acts directly either upon the muscle-structure itself or upon the peripheral nerve-endings in the muscles, producing contraction, and not paralysis. The influence of the drug upon the circulation is entirely subordinate and is not at present completely understood. Early in the poisoning there is a rise of the blood-pressure, which is, in great part, if not altogether, due to a direct

stimulation of the cardiac muscle and its contained ganglia. The action of the drug upon the vasomotor centres remains at present in doubt."

Physostigma increases peristaltic action. Traversa (Il Policlinico, No. 1, '98) recently studied the action of its main alkaloid, physostigmine, in this direction, and found that it not only exaggerates the peristaltic movements, but also causes a violent and generalized contraction of the intestine and, finally, tetanus and contractures. If the contraction predominates in the longitudinal fibres, the intestine becomes wrinkled; if in the circular, it is beaded, ringed, or, if the contraction is violent and diffuse, ribbon-like. The higher nerve-centres (the vagus, spinal cord, and abdominal sympathetic ganglia) have no influence upon the production of these phenomena.

A loop of intestine detached from the body and kept alive by artificial circulation gave the same reaction to physostigmine as intestines in the living body. He concludes, therefore, that the changes in motor activity do not depend upon the modification of the intestinal circulation. Physostigmine produces exaggerated peristalsis and violent and diffuse contractions of the intestine solely by excitation of the peripheral motor apparatus. Traversa further calls attention to the fact that, so far as the intestine is concerned, the action of physostigmine is identical in intensity and duration as well, and of effect with pilocarpine, not only nosographically, but mechanically.

Poisoning by Physostigma.—In toxic doses physostigma is a powerful poison, producing extreme muscular debility, vomiting (may be absent), and giddiness, followed by paralysis of the voluntary muscles, convulsive muscular twitch-

ings, and invariably a contraction of the pupil. The respirations become slow and irregular, the pulse slow and weak, and there is an abolition of all the reflexes. Death may occur either by cardiac syncope, or, if taken in smaller quantity, by paralysis of the respiratory centre and asphyxia. The mind is usually clear to the end. Death has occurred from 19 beans in the adult, 6 beans in a boy, and an extreme degree of collapse resulted from the hypodermic injection of $\frac{1}{20}$ grain of physostigmine into a child nine years of age: profuse diaphoresis, vomiting and collapse, with pulse 54, and scarcely perceptible and greatly diminished pupillary reflex (Lodderstädt).

Treatment of Poisoning by Physostigma.—If the crude drug (powdered beans) or extract have been swallowed, evacuation (by emetic or stomach-siphon) and lavage of the stomach are indicated. Atropine is the physiological antidote. It should be promptly administered, $\frac{1}{64}$ to $\frac{1}{24}$ grain being hypodermically injected in a severe case, repeated, as need be, until the pupils are dilated. Chloral is also antidotal to physostigmine. External heat to the body and respiratory and cardiac stimulants—such as digitalis, alcohol, and ammonia—will be found useful. Artificial respiration may be necessary.

Therapeutics. — SPASMODIC DISORDERS.—Physostigma is a useful remedy in all spasmodic disorders. In tetanus recovery has followed its use in more than 50 per cent. of reported cases. Fraser recommends it to be given until decided physiological effects are produced. He advises 1 grain of a good extract by the mouth ($\frac{1}{3}$ grain hypodermically), repeated every two hours, and increased or diminished according to the effect produced. In other nerve

affections great improvement has been noted, especially in chorea, in epilepsy, in locomotor ataxia, and in progressive paralysis. Trismus neonatorum is amenable to its action. In convulsive disorders of individual muscles (tic, twitching of the orbicularis, histrionic spasm, etc.) its action is satisfactory. In writers' cramp and in hiccough its use has been successful.

RESPIRATORY DISORDERS.—Physostigma is useful in bronchial asthma and emphysema, as it aids in the expulsion of the mucus by its action upon the muscular fibres in the walls of the bronchial tubes. Murrell has shown that this drug acts very favorably in night-sweats of phthisis; the effect of a single dose may persist for three or four weeks: he gave $\frac{1}{60}$ grain of extract in pill, two or three times during the night, or $\frac{1}{60}$ grain of eserine salt.

GASTRO-INTESTINAL DISORDERS.—Physostigma is an efficient remedy in atony of the intestines and in catarrh of the bowels. Hare commends its use in cases of gastric and intestinal dilatation, combined with *nux vomica*. In purgative pills it is useful to stimulate the muscular fibres of the intestines and thus favor peristalsis. In constipation due to defective secretion and to insufficient peristalsis the following is useful: Extract of physostigma, 3 grains; alcoholic extract of belladonna-leaves, 1 grain; resin of podophyllum, 3 grains; oil of cajuput, 4 minims. To be made into 12 pills; one or two to be taken at night. Bartholow advises equal parts of the tinctures of physostigma, *nux vomica*, and belladonna, 30 drops in water, to be taken morning and evening.

URINARY DISORDERS.—Physostigma has been used successfully in atony of the bladder. Giovanni, of Turin, has obtained good results from this drug in

cases of renal hæmorrhage. He combines it with ergotine: Extract of physostigma, 6 grains; ergotine, 30 grains; extract of gentian, a sufficient quantity. This makes twenty pills, one or two of which are taken daily, increased daily until effectual or the limit of tolerance is reached.

ANTIDOTAL USES.—Physostigmine is a physiological antidote in atropine poisoning. With the bromides it may be found useful in strychnine poisoning.

OPHTHALMIC DISORDERS.—The physostigmine salts are used extensively in ophthalmic practice on account of their myotic power and their power to relieve high intra-ocular tension. It is not well borne in acute inflammation, or if much ciliary congestion is present (M. L. Foster). It is positively contra-indicated in the acute stage of iritis, but is used by some oculists to break up iritic adhesions after the subsidence of the acute symptoms. According to some observers, it has a tendency to increase opacities of the crystalline lens; this should be borne in mind in connection with cases of incipient cataract. In corneal ulcerations it is often preferable to atropine, and its use may prevent prolapse of the iris after wound or ulceration of the cornea.

In the treatment of glaucoma this drug is generally satisfactory. A solution of physostigmine salicylate ($\frac{1}{2}$ to 1 grain to 1 ounce of recently-boiled water) instilled into the eye two to five times daily will reduce the tension and pain very decidedly. In some cases prolonged treatment results in permanent cure without iridectomy; in others the tension returns in a few hours after its discontinuance. In phlyctenular keratitis it is useful in diminishing photophobia. Cameron has used this drug successfully in paralytic mydriasis fol-

lowing diphtheria. Instillations of physostigma solution may be used to rapidly overcome atropine mydriasis when desired; as the action of atropine is the more persistent, it may return as the effects of the physostigmine wear off, and necessitate a repeated use of the latter. The solutions used in ophthalmological work generally vary in strength from $\frac{1}{2}$ to 2 grains of the physostigmine salt to the ounce of recently-boiled water.

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PICRIC ACID.—Picric acid (trinitrophenol; picronitric, picrinic, carbazotic, nitroanthic, or nitrophenisic acid) is obtained from phenol (carbolic acid) by nitration. It occurs in yellowish, lustrous, flat crystals, without odor, but of an intensely-bitter taste. It is soluble in alcohol, ether, chloroform, benzene, and slightly soluble in water. It is an antiseptic and an oxidizing substance.

Physiological Action.—The main action of picric acid seems to be exercised upon the blood, that of rabbits slowly poisoned by it having been found by Erb to assume a dirty-brownish hue. Distinct nuclei were found floating in the serum in their free state, and in the red corpuscles, while the white corpuscles were markedly increased in number. It causes distinct jaundice in man, in suitable doses, the skin, conjunctivæ, and urine being colored reddish yellow. Poisonous doses cause hypothermia, diarrhœa, collapse, and death.

Therapeutics.—Picric acid was formerly used internally in malarial diseases, in trichiniasis, and as an anthelmintic and tonic. Experience has shown that it possesses little or no action in these conditions. In doses larger than 5 grains it is poisonous (antidote: albumin).

It is chiefly used after the method of the French surgeons, Thierry and Filleul, for the treatment of burns and scalds. In solution (1 to 200) it is analgesic, antiseptic, and keratogenous, and its use is free from the accidents sometimes provoked by antiseptics, as it is not irritant, caustic, or toxic. Filleul (*l'Union Pharm.*, Dec., '95) advises the use of a solution obtained by adding the crystals to boiling water, the excess being removed by decanting. The golden-yellow solution thus obtained is left to cool in a vessel stoppered with cotton to insure asepsis. After cleansing the burn and pricking all blisters, compresses of tarlatan previously boiled to remove the stiffness, or plain aseptic cheese-cloth or gauze, are dipped into boiling water, then into the solution, wrung out, and applied in several thicknesses over the burning areas. Over this may be placed a layer of dry absorbent cotton, fastened in place by a roller bandage lightly applied. The dressing dries rapidly and may be left in place several days. For removal it is moistened with the solution so as to soften it. A fresh dressing is applied and left for a week. This application relieves all pain, inhibits suppuration, and leaves a smooth cicatrix (Thierry, *Provincial Med. Jour.*, Dec. 2, '95).

Hare suggests the following solution: Picric acid, 75 grains; alcohol, 2 $\frac{1}{2}$ ounces; distilled water, 2 pints. Mix. (See BURNS, TREATMENT.)

By use of picric acid healing in burns of the first and second degrees takes place rapidly without suppuration. The punctured vesicles must be accurately flattened out. No impermeable material must be placed over the simple gauze, which should be dipped in a saturated aqueous solution of the acid and applied after being squeezed fairly dry. Absorbent wool and a light gauze bandage further encourage evaporation, and thus

retard the growth of any bacteria which may have gained access to the wounded surface. A pair of thin rubber gloves may be used to avoid the staining of the dresser's hands by the acid. Renewal of the dressing need not take place for four or five days, unless there are clear signs of suppuration. Reckett (*Brit. Med. Jour.*, May 13, '99).

Picric acid recommended in the treatment of superficial burns: (1) because of its simplicity of application, (2) its painlessness, (3) the rapidity of its healing power, (4) absence of local irritation or of general toxic effect, and (5) the production of a smoother, more natural cicatrix than that obtained with other methods. McDonald (*Brit. Med. Jour.*, May 13, '99).

Picric acid is a simple and effective remedy in the treatment of burns, and it promotes rapid healing. It is best used in a $\frac{1}{95}$ solution in distilled water. It is also useful in the treatment of perionychia, soft corns, and intertrigo. The method of application is to place lint, soaked in the solution, over the affected part, and to cover this with non-absorbent wool or gutta-percha tissue. The dressing may be left on for from twelve to forty-eight hours. Milward (*Brit. Med. Jour.*, Feb. 21, 1903).

Picric acid has been employed by Cheron as a caustic and antiseptic after curetting the uterus for fungous endometritis; he used a watery solution (1 to 300). In a weaker watery solution (1 to 1000) it has been used in eczema, erysipelas, lymphangitis, fissured nipples, and in impetiginous eczema, after removing the crusts with oil.

In all those very troublesome cases of chronic simple diarrhœa and so-called putrid diarrhœa, with very offensive stools, often when opiates and other astringents have failed, picric acid in grain doses has given rapid relief. The icteric discoloration is first noticed after from 15 to 20 grains have been given, and it disappears shortly after the use of the drug is discontinued. W. Maclellan (*Brit. Med. Jour.*, Dec. 26, '96).

Acute eczema is rapidly relieved under the influence of picric acid. Applied as a pigment with a brush or piece of absorbent wool, even to an extensive surface, it is quite free from danger, and causes not the slightest pain, however vascular the surface may be. Almost immediately itching and smarting abate, and in a few days, when the protective crust is removed or separates, the underlying skin is found to be comparatively dry, free from redness, and covered with a young epidermis. W. Maclellan (*Brit. Med. Jour.*, Dec. 26, '96).

Generally speaking, picric acid is indicated in those forms of eczema in which the inflammation is acute and superficial, and where the lesions are mostly epidemic. The keratogenic properties of the agent find an excellent field of action in acute eczemas with the swelling of the integument, superficial ulceration, and weeping. In acute eczema a cure is effected in from ten to fifteen days. A solution of 3 drachms of picric acid in one quart of tepid boiling water is painted over and somewhat beyond the affected surfaces; the parts are then wrapped in lint wrung out of the same solution, and over this is placed a covering of cotton-wool. Oiled silk should not be used. The dressing should be renewed every two or three days. Aubert (*Thèse de Paris*, No. 32, '97).

Striking results obtained in the treatment of acute eczema and of various forms of artificial dermatitis from picric acid. The affected regions are covered with compresses dipped in a saturated aqueous solution, and enveloped in impermeable tissue. The dressing is changed daily. It possesses no advantage in chronic eczema. Leredde (*Ann. de Derm. et de Syph.*, June, '97).

Picric acid has been used in watery solution (15 grains to 1 ounce) as a test for albumin in urine. Though delicate, it is unreliable, as it also precipitates mucin, peptones, and potassium salts. It has also been used for the detection of sugar in urine, but is inferior to other well-known tests.

In pathological and histological work

picric acid is used for staining and fixing specimens. In combination it is also used for the decalcification of bones and teeth.

PILOCARPINE. See JABORANDI.

PIPERAZIN. — Piperazin (pyrazin hexahydride, dispermin, di-ethylene-diamin; piperazidin; ethylene-imin) is obtained by the action of ammonia upon ethylene bromide or chloride. It occurs in colorless, transparent, deliquescent needles, which absorb carbonic acid from the air. It is very soluble in water, the solution being practically tasteless and having an alkaline reaction. It must be kept from the air.

Piperazin is incompatible with alkalis and the salts of iron, tannic acid, alum, preparations of cinchona, Donovan's solution, potassium permanganate, sodium salicylate, acetanilid, and phenacetin.

Dose.—The dose of piperazin is 15 grains per day. This quantity is dissolved in a pint of plain or carbonated water and taken in tumblerfuls at equal intervals. The solution must be prepared fresh each day.

It cannot be prescribed in pill form on account of its highly hygroscopical property.

Physiological Action. — Piperazin forms with uric acid piperazin urate, a neutral and very soluble salt, even if the uric acid is present in excess. Upon its solvent power over uric acid rests its value in practice. In the laboratory it will act not only upon granular uric acid, but upon the hardest uric-acid calculi, and if the calculi are not composed of pure uric acid, it will cause them to disintegrate by dissolving out the uric acid and leaving the rest to crumble. The albuminous substances forming a

part of calculi are also dissolved. Piperazin will render soluble twelve times as much uric acid as lithium carbonate; moreover, piperazin urate is seven times as soluble in water as lithium urate.

When taken in moderate doses, it is quickly eliminated by the kidneys, and gives the urine a brownish-red color. Ebstein and Sprague did not find by examination of the latter that the output of uric acid or urea was increased; indeed, Vogt has argued that in doses of 15 grains a day it checked uric-acid elimination.

Regarding piperazin, following conclusions are formulated: 1. Piperazin is not wholly oxidized in the body, and may be detected in the urine of those to whom it is exhibited. 2. In solutions of 1 per cent. in normal urine, when kept in contact at a temperature of 102.2° F. for a given time, it has the property of dissolving to a great extent a fragment of a uric-acid calculus. 3. The stronger the solution of piperazin in urine (up to 7.5—), the earlier did the solvent action begin and the more rapid was the completion. 4. Notwithstanding this, with the stronger solutions of piperazin in urine the rate of solubility was not so markedly rapid over the weaker solutions as might be expected. 5. The solvent action in similar circumstances was greater than any other of the substances employed: namely, borax, lithium citrate, sodium carbonate, and potassium citrate. 6. Piperazin, in weak and strong solutions in urine, converted the undissolved portion of the calculus into a soft granular or pulpy condition. 7. Neither borax, lithium citrate, sodium carbonate, nor potassium citrate, in similar circumstances, rendered the fragment of calculus soft or pulpy. John Gordon (Brit. Med. Jour., June 16, '94).

Poisoning by Piperazin. — D. D. Stewart (Ther. Gaz., Feb., '94) has noticed untoward effects when large doses have been given: Feelings of nervousness and apprehension (hallucinations); intermittent clonic spasms of

the upper extremities, spreading to the muscles of the abdomen and legs, the patient becoming dazed, unable to think clearly, and for some hours partly unconscious; muscular prostration, with inco-ordination; coarse tremors, uncertainty of gait for several days, due rather to impairment of co-ordination than to any paretic condition of the muscles.

Case of poisoning from 20 grains of piperazin taken at once. When seen, three or four hours after taking the drug, the patient was found cyanosed and semicomatose, with pupils contracted; pulse, 50; and temperature, 97.4° F. The respiration was depressed and muttering delirium present. Tips of fingers and lips were cyanotic. Loss of motion complete in lower limbs, but sensation almost intact. Reaction established after several hours. Next day loss of motion returned and hypostatic congestion of both lungs present. On sixth day of treatment paraplegia disappeared. C. H. P. Slaughter (Med. News, Mar. 14, '96).

Treatment of Poisoning by Piperazin.

—In the case mentioned by Slaughter cardiac and respiratory stimulants were administered. External heat was applied to the limbs and trunk, and the lower limbs were elevated. A high, stimulating rectal injection was administered and the patient was catheterized. The paralytic symptoms (paraplegia) were treated with large doses of strychnine. The patient fully recovered.

Therapeutics. — Piperazin was introduced as a solvent of uric acid. It has been found an effective remedy in various manifestations of the uric-acid diathesis. Renal and vesical calculi, due to the deposit of uric acid, have been disintegrated and expelled through the use of piperazin. It has been given with the idea of preventing the formation of renal and vesical calculi. It is useful in irritation and inflammation of the

bladder arising from an excess of uric acid in the urine. For this purpose it may be given internally, or the bladder may be irrigated with a 1-per-cent. solution.

It has been used in diabetes and has been found especially useful when associated with gout. It has been found beneficial in renal colic and in hæmorrhage from the urinary passages.

Piperazin has little effect in lessening the acidity of the urine, but causes a marked diminution in the amount of crystalline urates. The drug employed in doses of 15½ to 31 grains a day, in 5 cases of gout, seemed to possess no more energetic powers than the ordinary alkaline waters. Mordhorst (Les Nouv. Rem., May 8, '92).

In the uric-acid diathesis piperazin must be administered continuously for a fortnight before an opinion can be formed: 1. Diuresis is considerably increased, the urine passed in a case of arthritis having been doubled. 2. Specific gravity of the urine lowered, but it never becomes alkaline or even neutral. 3. The appetite is not affected, and no disturbance of the general condition has been observed. The hydrochloric salt of piperazin is better than free base-product, being less hygroscopical. Wittzack (Notes on New Remedies, Mar., '93).

Case of excruciating renal colic in a woman, the attacks recurring two or three times every month. The usual treatment by mineral waters and careful dieting utterly failed. Internal administration of piperazin in the daily dose of 15½ grains was tried. Attacks became mild, while the urine assumed a peculiar reddish color (due to the presence of urate of piperazin). During one such attack the patient voided with her urine a brownish, corroded, small-sized stone, after which the reddish tint became nearly imperceptible, and then disappeared altogether. Shortly afterward the attacks ceased, and up to the time of the report—a year and a half—had not recurred. Egoroff (Bolnitch. gaz. Botkina, No. 34, '94).

Piperazin extensively used. No toxic symptoms of any sort have ever been observed from a moderate dose, as of $\frac{1}{2}$ drachm daily, although the drug has been continued for long periods of time. The limit of tolerance seems to be about 1 drachm daily. It was found in experiments that the two different makes of basic piperazin on the market (neither of which, by the way, is Merck's) differed from each other quite markedly in degree of tonicity. This difference was ascertained to be due to a matter of concentration of the drug in the more toxic: *i.e.*, to a much smaller amount of water of crystallization. It is on account of this that a stable salt of piperazin is preferable for administration to the basic piperazin still so much used. D. D. Stewart (Med. News, Mar. 28, '96).

A solution in alcohol and water has been applied locally to gouty joints and swellings. Ritter advises the combination of piperazin and phenocoll for the relief of gout. Piperazin in 2-per-cent. solution has been injected hypodermically, in amounts equal to 3 grains a day, for the relief of lumbago and gouty manifestations. These injections gave rise to pain, but did not cause abscesses (Heubach). Other observers have witnessed the formation of abscesses after such use and condemn it.

Allied Substances.—LYCETOL.—This is also known as dimethyl-piperazin tartrate; it is claimed that this substance is superior to piperazin, as the tartaric acid is supposed to be converted into carbonic acid, alkalizing the blood, and dissolving uric acid. It occurs in a fine, granular, white powder, and is soluble in water. It has a diuretic effect, an agreeable taste, and is non-hygroscopical. It may be used in gout in daily doses of 15 to 30 grains.

If the theory be correct that in gout in general there is no increased formation of uric acid, but that the blood of gouty persons is only faintly alkaline and therefore less capable of holding uric

acid or its salts in solution, the administration of lycetol (the tartrate of a piperazin derivative) must produce the combined effects of its components. Lycetol also possesses the great advantages of having an agreeable taste and of being non-hygroscopical. Its aqueous solution has an agreeable acid taste, and if sugar be added it is cooling, like lemonade, and does not excite repugnance when administered for a long time. Wittzack (Allgemeine med. Central-Zeit., No. 7, '94).

LYSIDIN.—This is also known as methyl-glyoxalidin, or ethylene-ethenyl-diamin, and is obtained by dry distillation from sodium acetate with ethylenediamin hydrochlorate. It occurs in pinkish, hygroscopical crystals, having a mousy odor. It is readily soluble in water, and has been recommended by Ladenburg as being non-toxic, five times superior to piperazin in dissolving uric acid, and as not causing digestive troubles or albuminuria.

Lysidin tried in acute and chronic gout. It was given in daily progressive doses of $\frac{1}{4}$ to $1\frac{1}{4}$ drachms in 1 pint of gaseous water. Even concentrated solutions (1 to 100) were taken without repugnance, especially when iced. No untoward symptoms of any sort were observed, and no dislike for the medicine was expressed, even after continued use. Lysidin proved to be a powerful remedy for gout, the pain ceasing soon after its use was begun, the joints becoming supple and the tophi diminishing. E. Grawitz (Deut. med. Woch., No. 41, '94).

Piperazin and lysidin, as well as the ordinary alkalies, the lithium salts and sodium salicylate, do not exercise any special solvent effect upon sodium biurate and their administration to gouty subjects with the object of removing uratic deposits in the joints and tissues appears to be useless, and, moreover, it is apparently contra-indicated in gout on account of its leading to an increased formation of uric acid in the kidneys. Luff (Lancet, June 11, '98).

PITYRIASIS. See DERMATITIS EXFOLIATIVA.

PIX LIQUIDA.—Pix liquida (U. S. P.), or tar, is an empyreumatic oleoresin obtained by the destructive distillation of the wood of *Pinus palustris* and of other species of *Pinus* (nat. ord., *Coniferae*) of Europe and America, that coming from North Carolina and Sweden being the best. It occurs as a thick, dark, viscous mass, having a peculiar odor, contains oil of turpentine, pyrocatechin, acetic acid, acetone, creasote, phenol, xylol, methylic acid, etc., and is blackened by wood-smoke. It is soluble in less than its own bulk of alcohol, ether, or chloroform, and is slightly soluble in the volatile and fixed oils. By distillation it yields pyroligneous acid, and an empyreumatic oil called oil of tar, which is official. Oil of tar, when fresh, is almost colorless, but with age it becomes oxidized and becomes dark-reddish brown in color; it is a volatile fluid, of acid reaction, has the odor and taste of tar, and is soluble in alcohol. The residue, after distillation, is pitch (pix solida): a black solid which has a shining surface on fracture, melts in boiling water, and consists of resin and various empyreumatic resinous products which are collectively called "pyretin." Pix solida is chiefly used in the preparation of plasters, and is entirely different from the residue of coal-tar, or "gas-pitch."

Preparations and Doses.—Pix liquida, U. S. P. (tar), $\frac{1}{2}$ to 1 drachm.

Oleum picis liquidæ, U. S. P. (oil of tar).

Syrupus picis liquidæ, U. S. P. (syrup of tar), 1 to 4 drachms.

Unguentum picis liquidæ, U. S. P. (tar, 50 per cent.).

UNOFFICIAL PREPARATIONS.—Aqua picis, G. P. (tar, 1 part; water, 4 parts), 1 to 2 pints daily.

Liquor picis alkalinus, Bulkley (tar,

2 parts; caustic potash, 1 part; water, 5 parts).

Pix saccharatum (saccharated tar; tar, 4 per cent.).

Vinum picis, N. F. (tar, 1 pint; glycerin, white wine, and honey, of each, $\frac{1}{2}$ pint; dilute acetic acid, 1 oz.; boiling water, 3 quarts), 1 to 4 ounces.

Physiological Action and Poisoning by Pix Liquida.—By reason of its irritant properties, tar may produce a papular, erythematous, rubeolous, urticarial, or acneiform eruption; the last has been called acne picealis (tar-acne) by Hebra. Tar is absorbed readily, and, if a considerable area is exposed to its action, poisonous symptoms similar to those of poisoning by phenol will appear: fever, foul tongue, eructations, vomiting and diarrhœa, with epigastric pain, tarry evacuations, and severe headache or a sensation of heaviness or oppression; strangury and ischuria, with darkish urine turning almost black in color and emitting, like the stools, the odor of tar. When taken internally, tar may give rise to erythema, vesicles, or papules, accompanied by severe itching. Long-continued or large doses of tar give rise to anorexia and indigestion, depress the heart's action, and cause nervous exhaustion. A fatal case is reported by Taylor, where death was caused by the ingestion of oil of tar. Large quantities of tar have sometimes been taken with no apparent ill effect. Children and young persons, as a rule, are most susceptible.

Lysol, a derivative of tar, caused toxic symptoms in a case reported by Reich. The application of pure lysol to a large part of the body of a young man was followed by loss of consciousness and convulsions, violent dermatitis, and the presence of albumin in the urine for two days. *Per contra*, Potjan reports a

case where a drachm of lysol was swallowed without causing untoward results.

Treatment of Poisoning by Pix Liquida.—The treatment of poisoning by pix liquida is similar to that advised for poisoning by phenol. If the poisoning result from the external application of the drug, suspension of the applications may cause an abatement of the symptoms, with copious diaphoresis and more or less diuresis, the urine turning from black to olive-green and becoming lighter in color until the normal is reached.

Therapeutics. — **DISORDERS OF THE RESPIRATORY TRACT.**—The vapor of tar is used largely for inhalations in diseases of the respiratory tract. In ozæna Moire recommends the following: Powdered camphor, 1 1/2 drachms; tincture of iodine, 3 drachms; iodide of potassium, 30 grains; tar, 3 1/2 drachms; alcohol (90°), 3 ounces; water, 6 ounces. This mixture is placed in a vessel over a water-bath, and the fumes are inhaled for two or three minutes. The nares are then cleansed by spraying with a 1-per-cent.-carbolyzed solution.

For use in pulmonary disorders with excessive secretions the tar, mixed with carbonate of potassium (24 to 1) to neutralize the pyroligneous acid, is placed in a cup over a water-bath heated by a spirit-lamp; the fumes of hot tar-water or wine of tar may be inhaled by means of a steam-atomizer; oil of tar diluted with some other oil or fluid cosmolin may be used in an atomizer; the vapor from heated tar may be inhaled. Inhalations, in any of these forms, are of value in bronchitis, especially in the subacute and chronic stages, and in winter coughs. In the bronchorrhœa of phthisis it is often useful. In connection with these inhalations tar may be given internally in the form of pills or

capsules (2 grains), in milk or beer (1/2 drachm to 1/2 ounce daily), or tar-water (1 to 2 pints daily), or wine of tar (1 to 4 ounces).

CATARRHAL DISORDERS.—Tar has a specific action in common with all balsamics, not only upon the mucous membranes of the respiratory passages, but elsewhere. In health it stimulates secretion; when hypersecretion is present, tar diminishes it. Hence in addition to its usefulness in disorders of the respiratory mucous membrane it is a valuable agent in chronic or subacute vesical, urethral, and vaginal catarrh. Injections of tar-water have given good results in chronic cystitis.

In obstinate diarrhœa H. C. Wood recommends a mixture of tar made as follows: Add a pint of tar to a gallon of lime-water, and allow this solution to stand a week, stirring it every few hours. Decant the clear liquid and percolate it through powdered wild-cherry bark, allowing 1 ounce of the bark for each pint of the liquid used. The dose is a wineglassful.

CUTANEOUS DISORDERS.—In cutaneous disorders, especially those in which the mucous layer is principally involved, tar is an effective remedy. In eczema and psoriasis the tarry preparations are very useful, and are more effective when applied directly to the diseased surface. In eczema it gives the best results when applied after the subsidence of active inflammation; if begun earlier it is apt to aggravate the disease; the indications for the use of tar is a condition of subacute inflammation accompanied by a dry, scaly surface, with more or less hyperæmia and pruritus, inflammatory products still remaining in the tissues. It is best to begin with a mild preparation: Tar ointment, 1 part; zinc ointment, 3 parts. Stronger applications

may be made later. The applications of tar may be continuous or intermittent.

In the dry chronic eczema of children the following is useful: Tar, 1 part; precipitated sulphur, 1 part; zinc ointment, 16 parts. Mix and apply night and morning (Hare).

Bulkley advises liquor picis alkalinus in the treatment of chronic eczema.

For psoriasis tar may be used as a stimulant in the same manner, but it is not so much used as formerly, having been superseded by chrysarobin.

Tar, in the form of soap, ointment, or liquor picis alkalinus (Bulkley), may be used in the treatment of scabies, tinea capitis, and lepra.

Care should always be taken in applying tar, lest it excite dermatitis or acne picealis.

In prurigo tar is often valuable. In pruritus ani a weakened tar ointment will often afford relief.

A useful application to hæmorrhoids is the following: Tar and alcoholic extract of belladonna-leaves, of each, 45 grains; glycerite of starch, 1 ounce. This is to be applied morning and evening.

Tar ointment in full strength, or modified, will be of service in lichen, comedo, sycosis, pemphigus, lupus erythematosus, and lupus vulgaris. Stern has observed that, when tar is allowed to stand in a warm place for several weeks, it separates into two layers, the upper of which is thin, syrupy, and devoid of irritant properties; an ointment prepared with this is advised when a mild effect is desired.

Derivatives and Allied Compounds.—

LYSOL.—Lysol is an antiseptic preparation made by dissolving in fat, and subsequently saponifying with alcohol, that part of tar-oil which boils between 374° and 392° F. It occurs as a clear, brown,

oily-looking liquid, having a feeble, aromatic, creasote-like odor. It contains 50 per cent. of cresols, is miscible with water, forming a clear, soapy, frothing liquid. It is also soluble in alcohol, chloroform, glycerin, etc. Lysol is five times stronger than carbolic acid, and eight times less poisonous. It is used in 0.3- to 1-per-cent. solution for dressing wounds and injuries, in diphtheria, and in cutaneous disorders.

In 2- to 4-per-cent. solution it may be used for disinfecting the hands and surgical instruments. Haenle claims that it does not affect the operator's hands unpleasantly, but renders the skin soft and supple. It has also been used and recommended in gynæcology and general surgery by Cramer, Parvin, Haenle, Michelsen, etc., and in skin diseases by Unna and others (especially in lupus by Leslie Phillips). Upon mucous membranes a stronger solution than 2 per cent. should not be used. Lysol has been given internally in dyspepsia in doses of $\frac{3}{4}$ to 8 grains after meals, the taste being disguised by spirit of peppermint.

PIXOL.—This disinfectant is made by dissolving 1 pound of green soap in 3 pounds of tar, and slowly adding a solution of a little more than 3 $\frac{1}{2}$ ounces of either potassium or soda dissolved in 3 pints of water. This makes a syrupy fluid which in a 5-per-cent. dilution is used for disinfecting linen and the hands. Dejecta may be disinfected by using a 10-per-cent. solution, which is said to be fatal to the micro-organisms of suppuration, anthrax, cholera, and enteric fever.

PLAGUE (BUBONIC PLAGUE).

Definition.—A virulent infectious disease due to a specific organism, characterized by the formation of one or more

buboes or by the development of a violent form of primary confluent pneumonia.

Varieties.—Two varieties of this disease are usually recognized: the *simple bubonic*, in which buboes appear in the femoral, inguinal, axillary, cervical, or tonsillar regions; and the *pneumonic*, in which no buboes appear on the surface, the septic process manifesting itself mainly as a septicæmia, of which the lungs, the mesentery, the gastro-intestinal tract, the kidneys, and the brain are the main centres.

Reviewing the opinions expressed generally, the following appears to be a rational classification of the various forms of plague: 1. With enlarged glands (gravity according to symptoms and severity of attack). 2. Without enlarged glands (almost always fatal). Brigadier-General Gatacre (Report on Bubonic Plague, Bombay, '97).

Symptoms.—The disease is suddenly ushered in with a chill, the temperature rising somewhere between 101° and 105° F. The patient reels like a drunkard, owing to marked vertigo, and complains of violent headache and great lassitude. This sudden and early exhaustion is apparent in the features, the drooping eyelids, the apathetic air, and the evident indifference to surroundings constituting the *facies pestica* characteristic of the disease. The respiration is usually rapid, the pulse also; the conjunctivæ are congested, and keratitis, iritis, or panophthalmia are sometimes observed. The tongue is swollen, shows the impression of the teeth, and is covered with a whitish fur resembling mother-of-pearl (Bulard).

In the bubonic form the bubo appears during the first hours of the malady and is usually unique. In the order of frequency it presents itself in the groin, the axilla, or the neck. It develops with rapidity and is well advanced as early as the beginning of the second day, and is

always very sensitive to the touch almost from the start. The neighboring tissues are tumefied and œdematous, especially in the parotid region. When this locality is invaded œdema of the larynx is to be feared.

On the second day the bubo is about the size of a pigeon's egg, and there is aggravation of all the constitutional symptoms, the pulse reaching sometimes 140. Delirium now appears and the stage of apathy is replaced by one of excitement, during which the patient may try to get up. Psychical disorders become manifest, fixed ideas predominating. Functional disturbances of speech are also frequently observed. On the third day all the symptoms become still further aggravated, the pulse reaching 140 or beyond, and the bubo attains perhaps the size of a hen's egg, and suppurates. Occasionally it becomes gangrenous. Carbuncles may develop in different parts of the organism. Extensive petechiæ are usual: the "plague-spots" of older writers. Hæmorrhages from mucous membranes, the nose, the lungs, etc., are frequently observed. In some epidemics hæmorrhages are witnessed in all cases, the buboes assuming an hæmorrhagic type.

The most frequent form of the plague is the septic-hæmorrhagic, characterized by primary hæmorrhagic buboes, most common in the groin, axilla, or cervical region. The surrounding tissue is frequently markedly œdematous. There are numerous hæmorrhages of variable sizes in different organs. There is acute enlargement of the spleen (spleen-tumor). Various lymph-organs, the lymphatic glands, and follicles of the intestine, mouth, and also of the tonsils are more or less involved. Commission for the Study of Plague, Imperial Academy of Sciences of Vienna (Wiener klin. Woch., Mar. 20, '97).

Death, in the majority of fatal cases, generally occurs about the fourth day, either from toxic paralysis of the respira-

tory or cardiac centres or from collapse. If the first four or five days—the acute stage—are passed safely, the chances of recovery are favorable. On the other hand, a stage of marasmus or profound depression may appear on the fifth day and the patient succumb on the sixth. Much depends upon the condition of the heart. Some cases, especially in children, are very benign, showing but an insignificant rise in temperature, slight inguinal or axillary pain, general depression, and ephemeral torpor. Such cases, however, are apt to occur early in the course of an epidemic. On the whole, the disease shows a very high rate of mortality.

Of 4179 patients treated for plague at hospital at Poona, India, 2836 died, the mortality being slightly greater in males than females, and distinctly lower in children. Of the fatal cases, 74 per cent. were bubonic. The non-bubonic forms, which were largely pneumonic or septic, were of the malignant class and showed high mortality,—about 75 per cent. Buboes occurred most frequently in the femoral region. The main sequels were infiltration and sloughing of the skin and necrosis of bone. Disturbance of speech was very common, particularly a peculiar drawl and inability to articulate certain words; the voice often resembled that of a boy at the age of puberty. E. L. Marsh (Glasgow Med. Jour., Jan., '99).

In the pneumonic or septic variety there is profound septicæmia. The pulmonary inflammation closely resembles commencing influenza (Lewin) and does not show clear physical signs. It is a form of confluent lobar pneumonia without apparent or noticeable implication of the lymphatic system. It also begins with a chill, severe pain in the side, and more or less severe cough with rusty expectoration. The plague bacillus is always found in the latter. In this variety

death may occur within twenty-four hours.

Some epidemics exhibit symptoms representing both varieties.

Diagnosis. — Characteristic symptoms were noted by Lewin during the last Bombay epidemic. The sudden exhaustion and weakness at the commencement of the disease is the first of these; no other fever, even on the first day, is characterized by such extreme debility. Neither is the moist, non-tremulous mother-of-pearl-like tongue of Bulard met with in any other disease.

Besides the typical symptoms, the bubo, and examination of the sputum for the plague bacillus in the pneumonic form, examination of the blood for bacilli, according to Abel (Centralb. f. Bakt., Apr. 24, '97), is of the greatest importance. The specific organisms have been shown by Kitasato to persist in the blood for three or four weeks after the onset of the disease. Examination of the blood, however, may be fallacious, owing to variability of the bacillus, leading to confusion with other forms. The best confirmatory evidence is the result of a broth or agar cultivation. Inoculation experiments are also advisable, and, as infection is often a mixed one, the animals used should have been previously subjected to "vaccination" against streptococci. A fair quantity of blood should be used and kept at a temperature of 37° C. (98.5° F.) for ten or twelve hours before being cultivated. The urine practically always contains albumin and plague bacilli, the latter often persisting for a week after convalescence.

Plague bacilli are found in long and short forms, with an intermediate stage. Their length appears to be inversely proportional to the nutritional value of the culture-medium. The most characteristic appearance is that of sharply and

repeatedly bent chains of immobile spindle-shaped bacteria, almost as small as cocci. They are decolorized by Gram's method, and with weak solutions of staining reagents show a clear space in the centre of the rod. The bacillus grows aërobically and anaërobically; it causes acid formation, but will grow in quite strongly alkaline solutions. It forms characteristic growths on agar and in bouillon. The best medium is an alkaline solution of peptone containing 1 or 2 per cent. of gelatin. It is pathogenic to all the small laboratory animals with the exception of pigeons. The micro-organism is rapidly killed by drying at a temperature of 30° C. and upward, over concentrated sulphuric acid, but is much less affected by slow desiccation at lower temperatures. Even at the room-temperature rapid drying is much more lethal to them than slow drying in tissues and fabrics.

The diseases for which plague may be mistaken are typhoid fever, typhus fever, and splenic fever, and in the pneumonic variety it may at its onset be mistaken for influenza. It is distinguished from typhoid fever by its sudden onset, by the absence of the rash and the abdominal symptoms, and in a few days by the appearance of the bubo. Typhus fever has a longer fever stage, viz.: fourteen days. The difficulties chiefly occur in the severe cases without buboes, and in the mild cases with slightly enlarged glands which simulate adenitis, the so-called *pestis minor*, or *pestis ambulans*; in all cases, however, the diagnosis can be established by finding the characteristic bacillus. J. Milford Atkinson (*Lancet*, Jan. 26, 1901).

For an early diagnosis of bubonic plague the most satisfactory method is that of aspiration of one of the recent swollen glands by means of a hypodermic syringe. With the material in the syringe: 1. A drop is used to make culture in melted agar tubes or in bouillon from which dilutions, cultures, and

plates can be made. 2. A drop is allowed to fall on a slide, which is then smeared by a platinum needle, to be used for direct examination. 3. The remainder is injected into a mouse or a rat. If examination of the specimens on the glass slides shows the presence of large numbers of characteristic, short, bipolar-staining bacilli, that decolor by Gram's method, the case at once becomes more than suspicious. By the second day the inoculated animal is either dead or very ill, and an absolute diagnosis can be made. J. J. Curry (*Boston Med. and Surg. Jour.*, March 21, 1901).

Etiology. — Small animals, monkeys, squirrels, rats, etc., die in great numbers during epidemics of plague, rats particularly—and they seem to be first to suffer. This fact has suggested that the specific organism discovered by Kitasato, or that described by Yersin, might be of telluric origin. Whether this be the case or not, there is much evidence in favor of the contention that plague is a soil-bred and soil-supported disease. The bacillus of plague has been found in the soil and in the dust of houses inhabited by sufferers. This micro-organism once transported to a suitable soil may there flourish and form foci of infection. According to Robert Koch (*Deut. med. Woch.*, July 14, '98), there are three endemic main plague foci in Asia: Mesopotamia, Thibet, and Assir, while he locates the primary source of the disease in the English territory of Uganda.

There does not appear to be a necessary connection between the infection of animals and outbreaks among men. Although small animals and insects, including the domestic fly and the flea, die of the disease and may spread it, it seems more logical that general insanitary conditions, enhanced by the long prevalence of drought, should tend to awaken the latent activity of the germ.

After the activity of the plague ba-

cillus has reached a certain potency, through appropriate surroundings, human beings are assailed as well as the lower animals, the latter succumbing first, owing to their greater exposure to toxic germs through promiscuous feeding. The tissues most vulnerable to the Kitasato bacillus are the skin and the mucous membrane, especially when these are deprived of their protective covering. Yamagiwa (*Annales de l'Inst. Pasteur*, Aug., '97) found a wound of the surface in one out of every seven cases examined. The next portal of invasion is believed by some to be the alimentary and respiratory tracts. Once beneath the surface, the bacillus is thought to penetrate the lymphatic system and thence to invade the system at large.

The development of the bubo is one of the earliest symptoms; it precedes the profound disturbance of the nervous system. The disease originates in an "infection" through the skin, remaining localized for a time. The systemic or general infection develops from a local centre or focus of origin. Report of Austrian Plague-Commission (*Philadelphia Med. Jour.*, Jan. 28, '99).

The plague bacillus is not devitalized by a three weeks' exposure to a temperature of 24° C. below zero. This bacillus can develop slowly, but steadily, at a temperature of from 20° C to 27° C. Near the freezing-point it remains inert. Chinese houses, with their bad ventilation and other unhygienic conditions, furnish favorable conditions for the development of the plague bacillus. N. Noguchi (*Sei-i-Kwai Med. Jour.*, May 31, 1900).

Although all classes suffer, certain conditions of life appear to confer immunity. Persons living in-doors are more likely to suffer than those who are often exposed to the sun's rays. The boating population of China who live exclusively upon the water seldom suffer. Persons who occupy the upper stories of a dwelling are less frequently attacked than those

living upon the ground-floor. The infection may be transmitted by means of body-linen, clothes, bedding, rags, bagging, carpets, etc. Foodstuffs, grain, sweetmeats, etc., are also thought capable, under suitable conditions, of transmitting infectious germs. Few nurses or attendants upon the sick are attacked if their habits are cleanly; even those whose duty includes the disinfection of infected dwellings have been free from the disease when personal cleanliness obtained. During the epidemic in Canton, during which upward of 30,000 Chinese died, not one of the 300 American or English residents, according to the China Medical Missionary, was affected.

Pathology.—In the buboes and the glands involved Childe (*Brit. Med. Jour.*, Sept. 24, '98) found bacilli in enormous numbers both among the cells of the gland-tissue and among the lymphatic vessels and the blood-corpuscles extravasated into the gland, as well as in the hæmorrhage outside the gland. In cases of plague-septicæmia they were similarly present in the large characteristic glands. In the kidney the bacilli could also be seen, especially among the blood-cells of the tubules into which hæmorrhage had occurred. In the spleen they were also present, among the cells of the splenic tissue and in the hæmorrhagic areas. They were present in the liver, especially in cases in which engorgement and hæmorrhage were marked. The bacilli were present in the pneumonic areas of plague-pneumonia, in profusion among the catarrhal epithelial cells and leucocytes that fill the alveoli and terminal bronchioles, as well as among the blood-corpuscles of the alveoli into which hæmorrhages occurred.

Observations conducted upon 27 patients and bodies. These revealed the presence of a bacillus corresponding to

Yersin's, and therefore not to Kitasato's. It was pathogenic for mice, rats, rabbits, guinea-pigs, and cats, while dogs, fowls, and pigeons were refractory. The bacillus had but little power of resistance to antiseptics. It was killed at once by 1-in-20 carbolic acid; in 1 in 200 it survived five minutes, but after fifteen it could no longer grow on nutritive media. In 1-in-1000 sublimate solution it perished at once, in 1 in 10,000 not for five minutes. Saturated lime-water for five minutes stops its growth permanently, while sunlight kills it in less than four hours. Ogata (Centralb. f. Bakt., xxi, 20, 21, '97).

The author found that the chief distinctions are afforded by the lymphatic glands, and they will depend upon whether the glands were primarily or secondarily affected. Primary involvement may be of two kinds: of the first order being the point of original reception of the virus; of the second order representing the extension to a second, contiguous group of glands. Buboes of the second order are less marked than those of the first. Secondary buboes may be found in any or all glands, within the body, and at a distance from the primary lesions, infection having followed through the blood-circulation. Primary buboes of the first and second order are described minutely, as well as tonsillar infections. The spleen in plague is enlarged moderately and the consistence is somewhat diminished. The color is deeper than normal, but it is not the type of the acute splenic tumor of the septicæmias. The author emphasizes that, although the spleens in the autopsies made all contained bacilli, often in very large numbers, the cases themselves were examples of the bubonic, and not of the septicæmic, variety *per se* of the disease. The morbid anatomy of the experimental disease in the guinea-pig is also given minutely. Two main types of the plague—bubonic and pneumonic—may be considered as established by observation. Simon Flexner (Univ. of Penna. Med. Bull., Aug., 1901).

Treatment.—The medicinal treatment of plague, judging from the great mor-

talities of that disease—80 to 90 per cent.—does not seem to merit much confidence. "A plan of treatment which succeeds in one case totally fails in another" said Gatacre in his report on the bubonic plague in Bombay of 1897. He found that calomel was largely used: an index of its general worth. Cantlie (Brit. Med. Jour., p. 249, '97) states that this agent should be given in from 5- to 10-grain doses, and be followed by a saline in some five hours' time. This experienced author recommends that from the very onset, or certainly after twenty-four or forty-eight hours, it will be found necessary to stimulate the patient by food, alcohol, or medicine. Food should be given in small quantities, frequently repeated, and of a kind which is easily digested. Essence of beef, in fluid or jelly form, is recommended. Ox-tail soup, mutton-broth, beef-tea, and chicken-tea are also useful. Milk with ice, sipped slowly, and ice-cream are particularly grateful. Thirst is a marked symptom, and ice to suck, if not kept up too long, water or lemon and water (not lemonade) to drink, iced beer and stout, brandy, or whisky diluted with three or four times its quantity of water (not aerated waters) may all be used. When the pulse shows signs of failing or collapse or faintness supervenes, alcohol is beneficial, and brandy is preferable to whisky. Cantlie found that active delirium is best controlled by cold to the head: Leiter's coils, ice-bag, or wet cloth. Hyoscine in $\frac{1}{100}$ -grain dose hypodermically is the most efficient and safe of the hypnotics. Morphine, in $\frac{1}{8}$ - to $\frac{1}{4}$ -grain dose subcutaneously in combination with atropine, is most useful when painful adenitis complicates the cerebral intoxication. Diarrhœa may be treated by salol in 10-grain doses, or by a suppository of morphine, $\frac{1}{4}$ grain; and cocaine, $\frac{1}{2}$ grain. Vom-

iting may be controlled by a mustard-plaster to the epigastrium, ice to suck, and an effervescent draught of a few drops of hydrocyanic acid and solution of morphine. For pyrexia Cantlie contends that chemical antipyretics should not be used. Frequent sponging with tepid water, ice to the head and nape of the neck, iced drinks, and a short application of the wet pack, with the administration of brandy by the mouth or rectum. Smelling-salts and strong ammonia to the nostrils often arouse a patient in collapse and permanently revive those apparently moribund. Hypodermic injections of ether must be used frequently and freely. Internally, ammonium carbonate in a tincture or decoction of cinchona is most useful, while digitalis and strophanthus are unsatisfactory. Camphor, either hypodermically in sterilized oil or as a 2-grain pill, is a direct stimulant and a stomachic carminative. Musk may be given in 5-grain doses every six hours. Strychnine sulphate in $\frac{1}{48}$ -grain dose hypodermically in 10 minims of distilled water is valuable. Inhalations of oxygen are also recommended. Abscesses should be opened when they point.

SEROTHERAPY.—Serotherapy has not as yet shown results warranting any conclusion as to its real merits. While Yersin's serum, according to Arnold (*Med. News*, Jan. 1, '98), reduced the mortality of severe cases from 80 or 90 to 50 per cent. and that of mild cases from 50 to 10 per cent., other observers, Clemow (*London Lancet*, May 6, '99), for instance, do not credit it with beneficial powers. This serum is prepared as follows: The subcutaneous injection into horses of a fresh plague-bacillus culture upon agar giving rise to a severe local swelling, ephemeral fever, and an abscess, Yersin resorts to venous inoculation, and

thus avoids the abscess-formation. Violent reaction follows these injections until, after repeated and stronger doses, immunization is accomplished. Three weeks after the last injection a serum is obtained by venesection that may be used therapeutically. It is important to remember, however, that this serum does not long retain its activity (E. Roux).

Prophylaxis.—The prophylactic measures indicated consist, first, of vigorous efforts calculated to antagonize unhygienic conditions, and, second, of preventive inoculations. J. M. Atkinson concludes that, the occurrence of plague being favored by the absence of sunshine and general insanitary conditions, such as obstruction to the free access of light and air to domestic dwellings, the steps to be taken to retard the progress of the disease are (a) general cleanliness and the free admission of light and air to domestic dwellings; (b) the immediate isolation of the sick and those who have been in close contact with the disease; (c) the careful and systematic disinfection of all premises in which cases occur and of latrines.

As to the best methods of disinfection, an exhaustive investigation led Abel (*Centralb. f. Bakt.*, Apr. 24, '97) to conclude that moist heat—*i.e.*, steam—was the most efficacious. Of chemical reagents, the best were 1-in-1000 sublimate in carbolic-sulphuric acid, lysol, and chloride of lime in 1-per-cent. solution. Carbolic acid proved useless in less than 5-per-cent. strength.

Schultz (*Archives des Scien. Biol. de l'Inst. Impér. de Méd. Expér. à St. Petersbourg*, tome vi, No. 5, '98) found that perchloride of mercury has a most powerful action in destroying the plague bacillus, but its strength depends on the medium in which the bacilli are contained. To disinfect clothes, etc., they

must be thoroughly soaked with the perchloride solution, which fact does away with its practical usefulness to a large extent. The addition of hydrochloric acid increases its disinfecting action. Though formalin in solution is 20 times less powerful than perchloride of mercury, in the form of gas it becomes a most reliable disinfectant, and is deemed the best for furniture, clothes, etc., especially as it injures them in no way.

Experiments showing that the duration of vitality of the plague bacillus in the bodies of buried animals continues from twenty-two to thirty days. Yokote (Centralb. f. Bakt., xxiii, p. 1030, '98).

The prophylactic fluid of Haffkine has been extensively used, apparently with encouraging results. In its preparation a luxurious crop of plague organisms is cultivated by adding to the nutritive media abundant quantities of fat exposed to free aëration. The fat used is clarified butter, which is suspended on the surface of the nutritious fluids. When the fluid is filled with a rich jungle of stalactites, the growth is shaken off from the drops of butter and brought down to the bottom of the liquid, leaving the butter on the surface free to produce a second crop of growth. In the course of a month, half a dozen successive crops are thus obtained, which fill the liquid, when shaken, with an opaque, milky emulsion. The micro-organisms in this fluid are killed by exposing them for one hour to a temperature of 70° C. In a quiet position in test-tubes two different substances are then obtained: a thick white sediment and a perfectly limpid fluid. Injected subcutaneously into animals they produce: (1) the sediment,—a local inflammation, and a nodule at the seat of inoculation, accompanied by little fever or general effect; and (2) the fluid,—a considerable rise of temperature, and a gen-

eral affection, with no noticeable local effects. (Haffkine.)

The injection of 3 cubic centimetres of prophylactic seems to be sufficient to effect the desired protection. It cannot arrest symptoms already started or that show themselves within a few hours, but the time necessary for it to produce the protective effect is very short.

In a careful analysis of the results of the inoculation it is shown that the efficacy of the prophylactic depends on the virulency of the microbe from which the lymph is prepared, and on the dose and its powers of producing a well-marked febrile reaction, and that it is more effective in preventing deaths than attacks. M. W. M. Haffkine and Lyons (Brit. Med. Jour., Jan. 8, '98).

In Hubli, India, from May 11th to August 23d, 33,880 persons were inoculated (24,138 twice, 9742 once). In all, 58,018 inoculations were performed in fifteen weeks. Actual plague deaths have averaged 85 per cent. in favor of the inoculated. Haffkine's inoculation method and sanitation and hygiene should be utilized together. The general health of the inoculated persons seems to be improved, as shown by the lower death-rate from "other causes." Leumann (Lancet, 10, '99).

Bubonic plague can be easily controlled by careful isolation and sanitation, one of the best disinfectants for rooms being formaldehyde-gas. All evacuations, sputum, clothing, bedding, etc., should be disinfected, and the patient kept isolated for one month after apparent recovery. Among those attendant on the sick, 1 cubic centimetre of the Haffkine prophylactic should be injected once a month. The only curative is the antipest serum of Yersin and Roux, 30 to 50 cubic centimetres of which should be injected at the earliest possible moment. This may also be used as a prophylactic in dose of 10 cubic centimetres repeated every ten days. Walter Wyman (Document 2165, Treasury Department, Washington, 1900; Med. News, May 12, 1900).

The treatment of plague by means of antitoxin serum has proved most suc-

cessful in the hands of Calmette and some other observers. Thus, at Oporto, during September, October, and November of last year, 142 patients were treated with serum, and only 22 died. The mortality among those treated with antiplague serum was therefore only 15 per cent. as compared with 63 per cent. among those not so treated. Calmette insists on the necessity of injecting the serum directly into the circulation; 20 cubic centimetres of antiplague serum are injected into a superficial vein of the patient's hand, forearm, or leg as soon as a case of plague is suspected without waiting for the results of bacteriological examination. If the fever does not subside completely in twenty-four hours, and if the diagnosis is confirmed, another injection of 20 cubic centimetres of serum must be given into a vein. These injections are absolutely harmless, and if care is taken to warm the serum to body-temperature before injection the patient experiences no discomfort from the injection. Serum injection is equally efficacious for the prophylaxis of plague in localities already infected, but the protection afforded is not a very lasting one and the injection must be renewed at the end of a week. Prophylactic injections need not, however, be given intravenously; a simple injection of 10 cubic centimetres under the skin of the abdomen is quite efficacious. The serum presents the immense advantage of conferring immunity in a few hours. J. L. Bunch (*Lancet*, Feb. 23, 1901).

Yersin's serum is a remedy of the greatest value in the treatment of bubonic plague; its action is bactericidal, as shown by the degeneration induced in the bacilli, as well as antitoxic. This double action of the serum is best secured by its early administration in large doses, both subcutaneously into the lymphatic area which drains toward the tube, and also intravenously. In very mild cases subcutaneous injection alone will probably suffice, but in severe cases the combined method should be employed. For those latter the initial combined dose should be perhaps from

150 to 300 cc., the proportion given intravenously varying with the relative severity of the general symptoms. D. L. Cairns (*Lancet*, May 9, 1903).

This substance renders a person immune for three months and acts within twenty-four hours. When inoculation is given in the incubation stage of the disease, that is, before signs of *plague* appear, it has in many cases the power to abort the disease. Inoculation has no effect on other diseases, except possibly eczema, which appears to be benefited by it. It confers a high degree of immunity and greatly reduces the number of plague attacks. When, in spite of inoculation, a person is attacked, his chances of recovery are greatly increased. B. R. Slaughter (*Johns Hopkins Hospital Bulletin*, November, 1903).

PLASTIC SURGERY.—Plastic surgery includes the various measures required to correct malformations due to defective embryonal development,—harelip, cleft palate, branchial fistula, and kindred conditions,—and deformities occurring as the result of cicatricial contraction after burns, ulcers, or other destructive agencies and disorders. Although plastic operations upon tendons, nerves, and bones are usually included under this head, it has been deemed more advantageous to the reader to consider the subjects in articles upon the various conditions in which such measures are indicated.

Plastic surgery (anaplasty) should not be confused with skin-grafting (transplantation). The former is limited to operations where the cuticle is merely loosened from the underlying tissues and slid from one point to another, or where pedunculated flaps are employed, while the latter refers to operations in which portions of skin are entirely severed from their original connections and used to fill defects elsewhere. The word *flap* should be confined to plastic sur-

gery, and the word *graft* to transplantation.

General Considerations.—In repairing defects the neighboring skin can generally be employed by merely stretching it, or by cutting more or less definite flaps and shoving them from one point to another. Occasionally it is desirable to use flaps with pedicles, obtaining them from the vicinity ("Indian method"), or from an extremity which can be approximated to the seat of operation and held there until union has taken place ("Italian method"). The pedicle is subsequently severed. Considerable twisting of the pedicle is often necessary. Frequently the skin must be extensively undermined in order to increase its mobility.

The applications of plastic surgery are exceedingly numerous. A crural ulcer, for instance, may be covered by a pedunculated flap from the other leg, the limbs being appropriately bound together during the process of healing; the cuticle of the hand may be replaced by flaps from the anterior or posterior surface of the trunk, the skin being sometimes elevated into a bridge and the hand slipped beneath; defects in the urethra and exstrophy of the bladder can be repaired with flaps from the scrotum or other adjacent parts; and some of the neatest plastic work is done in connection with cleft palate and repair of the perineum.

Double flaps are sometimes useful. For instance, if a single flap is turned from the neck into a total defect of the cheek, the raw side next the buccal cavity will cicatrize and contract, causing much deformity. This can be avoided by using two flaps with their raw sides together: one from the neck and one from the scalp, the hair of the head simulating a beard. In some operations it may be advantageous to permit the two flaps to grow together before

placing them in position; or the raw surface of a flap may be skin-grafted either before or after sewing it in place. Flaps may be bent upon themselves, rendering them thicker and supplying them with a cuticular covering on both sides; but this requires the sacrifice of so much skin from one region that it is seldom resorted to.

Flaps composed of skin and periosteum, or skin, periosteum, and bone, in undisturbed relation to one another, are often of service. They may be cut and chiseled from adjacent parts and employed to fill defects in bone—about the skull, for instance, or following operations for osteomyelitis of the tibia. König employs, in rhinoplastic work, skin-periosteal-bone flaps obtained from the forehead. Occasionally it is possible to chisel off a flake of bone through a small incision, without cutting a flap at all, and slide it from one spot to another by means of its loose areolar-tissue connections with the skin.

General Technique.—Asepsis is of prime importance. The avoidance of suppuration diminishes the size of the scar and the amount of cicatricial contraction, and there is less tendency to the cutting of sutures.

It should not be lost sight of that it may be preferable to cover defects with skin-grafts rather than to attempt extraordinary feats of plastic surgery. Especially is this true of raw surfaces from which flaps have been obtained.

Tension should be avoided as far as possible, relaxation sutures often being of utility in this regard. No more sutures should be employed than are really necessary, and they should be just tight enough to draw the parts together and no tighter.

In cutting flaps, about one-third should be allowed for shrinkage.

Care must be used in twisting pedicles not to cut off the vascular supply from the body of the flap. When it is possible to include a blood-vessel in the pedicle, this should be done. The bruising of flaps or their excessive handling must be avoided.

A certain amount of pressure on the part of the dressings is often advantageous, but it should not be great enough to endanger the free circulation of fluids.

Artificial warmth, in the shape of fomentations, poultices, etc., is apt to do more harm than good, and is, in general, unnecessary.

Oozing must be carefully checked, preferably without the use of ligatures. An accumulation of blood beneath a flap may seriously jeopard the success of an operation.

Hairs are readily transplanted in flaps comprising the entire thickness of the skin. This may be taken advantage of, for instance, in replacing portions of the bearded cheek from the scalp.

It is important to remember that puckers and irregularities following a plastic operation tend to smooth themselves out to a considerable extent, and what seems to be at first rather a rough piece of work may eventually become presentable. This should be no excuse, however, for careless or unsightly surgery.

Moderate discoloration of flaps, or the appearance of blisters, may mean superficial necrosis only, and not complete death of the flap.

In plastic surgery, dry dressings are generally preferable to moist ones.

When pedunculated flaps are used, the pedicle should not be cut until definite healing has taken place and the circulation has become thoroughly established. This may require two or three weeks.

Even then it is usually better to wait until the tissues have contracted and smoothed themselves out as much as possible before removing the unsightly hump sometimes resulting from a twisted pedicle. It is surprising how much "time" will often accomplish. (LEONARD FREEMAN, Assoc. Ed.)

Deformities of the Lips.

Harelip.—This common deformity is due to the non-union of the mesial nasal process with the superior maxillary process. It may assume various forms: (a) a mere notch in the red edge of the lip; (b) a cleft through the soft portion of the upper lip only; (c) a cleft through the lip and nostril and accompanied by cleft palate; (d) double harelip with a floating intermaxillary bone and cleft palate, a variety witnessed in one-tenth of all cases (F. J. Shepherd, Montreal Med. Jour., Jan., '99). In the latter case the intermaxillary bones usually project and are either covered by skin or connected with the nasal septum, projecting sometimes as far as the tip of the nose. When the cleft extends into the nose there is always a simultaneous defect in the alveolar border generally involving separation of the middle and lateral incisor teeth. Other deformities of the face, also due to defective development, are sometimes present besides harelip: congenital fissure of the cheek, eyelid, etc. Single harelip occurs most frequently on the left side. It is often traceable to heredity.

The writer concludes that the deformity is not caused by the formation of amniotic bands, as stated by some observers. For, as a rule, trauma caused by the latter are distinguished by their multiple character. If amniotic bands are present in a pregnant uterus, their effects are not confined to one part, but are usually also distributed over the trunk and extremities. The rare oc-

currence of amniotic deformities of the limbs in comparison with the rather frequently found examples of harelip makes it seem somewhat improbable that the development of amniotic bands plays any considerable rôle in the development of a typical harelip or cleft palate. It is known, moreover, that many individuals afflicted with harelip also present other evidences of incomplete development, in the brain, the spinal cord, the sensory organs, the vascular system, the urogenital tract and the abdominal wall. T. Haymann (*Archiv. f. klin. Chir.*, Vol. lxx, No. 4, 1903).

Treatment.—Operative procedures are obviously alone of value; but the age at which these should be resorted to has given rise to considerable discussion: a fact tending to show that a fixed time, —the sixth week, the third month, etc., —as recommended by various operators, cannot be adjusted to all cases. Indeed, the resisting powers of the child are of primary importance; for, while one may easily stand the operation a few weeks after birth, another will die from shock. Doubtless the best age for operation for harelip depends on the condition of the child and the character of the deformity; should the deformity involve only the soft parts and the child be healthy, Shepherd contends that one should operate at once. In simpler cases the earlier the operation, the better. Should the child be weakly, or the fissure be double and extend through the hard parts, then the operation ought to be postponed some weeks or even months. From six weeks to three months is probably the proper time for operating.

The following technique is that recommended by Shepherd: Chloroform is the best anæsthetic. The child should be wrapped in a sheet or large towel, so that the arms may be confined, and then held in the arms of a strong nurse. Sitting in front of the patient, the oper-

ator should first cut through the mucous membrane attaching the lip to the gum, and freely separate it so that the lips hang loosely. The edges of the cleft are then freely pared by using a narrow-bladed knife and transfixing the edge of the cleft well up to the nostril; the flap is cut free above, but below it is left on each side attached to the edge. As the two edges of the cleft are seldom the same length, one being usually distinctly longer than the other, on the longer side the soft parts should be more freely freshened. Both flaps should be cut as far as the red line of the lips. Any redundancy can be cut off without any trouble. The flaps should not be separated from the edges of the cleft below until several sutures have been placed in the lip above and the fastened edges of the cleft accurately adjusted near the nose. The paring from the shorter side is then cut away, and more or less, as occasion requires, of the tissue at the red portion of the lip removed; the flap of the long side is brought over as before, and adjusted as accurately as possible. During the operation an assistant compresses the sides of the cleft with his fingers. Should any blood get into the mouth, it must be at once removed with sponges on handles. Silk-worm-gut and horse-hair sutures are employed. Care should be taken not to go through the lip while suturing, but to dip down to the mucous membrane only; the stitches should range on each side at least one-eighth of an inch from the edge. If the sutures have not been satisfactorily placed or seem to pull too much, or if there is a slight unevenness, one should immediately take them out and reintroduce them. After the main sutures of silk-worm gut are placed, intermediate ones of horse-hair may be employed, and afterward the lip everted,

and the mucous membrane sutured in the mouth. He states that the most important points to be observed in the operation are: 1. Freeing the lip from the gum. 2. A free sacrifice of the edge of the cleft. 3. Accurate apposition of the parts.

In dressing, an antiseptic paint (iodoform, resin, oil, and alcohol) applied over a piece of lint or cotton is used. If the usual cheek-straps are applied to preserve tension, they should be made of diachylon plaster, and the cheek parts cut broader than the part running across the lip; they should interlace in the middle line, the cheeks being well pulled forward.

Zinc-paste dressing for harelip recommended as superior to others as to simplicity, convenience, and mechanical and antiseptic effects. This paste, first described by Socin in 1813, consists of zinc oxide, 50 parts; zinc chloride, 5 to 6 parts; water, 50 parts. After completing the operation, the suture-line is disinfected and carefully dried. The paste, freshly prepared, is applied over the whole upper lip with a brush or spatula, with one or two very thin layers of cotton for support. If the wound extends into the nostril, the paste should cover it throughout its extent, but without blocking the nostril. It dries rapidly and forms an air-tight, firmly-adherent covering, over which the nasal secretions run without dissolving it. It is non-irritating. The dressing is changed on the fourth to sixth day for removal of sutures. If not already loose, it can be slowly cut away with scissors. A fresh dressing is then applied, which is allowed to remain till separated spontaneously. Van Noorden (*Beit. zur. klin. Chir.*, B. 4, H. 2, '89).

Before operation it is very important to know that the child has not been exposed to any fevers, measles, or scarlatina. This is the one cause of failure. Another is the inordinate crying of the child, and also the too-early removal of

the stitches. Sepsis is the great cause of failure; sutures should not be removed too soon. Silk-worm gut is left in from six to ten days. Should primary union not occur, one should wait until the inflammatory action has subsided, and then freshen the edges and bring them together. After the operation there is often great difficulty in breathing through the nostrils, and rubber tubes introduced are often a great aid and prevent collapse of the nostrils.

It is advantageous to introduce a prophylactic suture before the freshening of the edges of the cleft is begun, so that the moment the dissection is ended the raw surfaces are brought in confrontation and the bleeding completely suppressed. Carl Beck (*Med. Monats.*, Apr. 3, '90).

Important points in the treatment of harelip include the following considerations: 1. Harelip babies are not necessarily feeble at birth, and by proper feeding can be kept up to the normal standard. 2. The field should be kept clean with aseptic washes before the operation. 3. One should operate in the sixth to the eighth week. 4. One should not slash with scissors, but cut and trim carefully with a knife. 5. The upper lip should be freed thoroughly from the jaw. 6. The nares should be anchored with shotted wire. 7. No pins or heavy outside sutures are to be used. 8. Crêpe lisse, not surgeon's plaster, is to be used. 9. The heavy inside stitches are to be left for six days. 10. After operation special attention should be given to the care of the bowels and to proper feeding, as on this very often hangs the whole success of the operation. Mumford (*Boston Med. and Surg. Jour.*, Mar. 3, '98).

In double harelip, when there is no projecting intermaxillary process, all the mucous membrane from the central portion is cut away and the flaps taken from the sides of the cleft as in single harelip; the central portion is sutured on each side to the lateral clefts, and the lateral

flaps run across to meet each other below the central portion, the lower part of which is freshened. What is in excess is cut away. Sometimes the central portion may be cut into the shape of a V and the lateral flaps adjusted to it. Where the intermaxillary bone projects the case is more difficult. In some cases, such as where the bone grows from the tip of the nose, it must be sacrificed, but it can be broken back and forced into the cleft. Sometimes it is necessary to pare the edges of the gums, and in some cases the bone is kept in position with wire or silk sutures. One should always try and save the intermaxillary bone.

When necessary, the entrance of blood into the air-passages may be prevented by placing the child in the Trendelenburg position, or holding it upright with the head inclined forward. The effects of hæmorrhage and shock may be combated with subcutaneous injections of large quantities of normal salt solution.

Hypertrophy of the Lips.—Undue thickness of one or both lips is occasionally observed in healthy individuals, but more frequently in strumous children. When the hypertrophy is sufficiently marked to disfigure the patient, operative procedures must be resorted to. The deformity is usually corrected by removing an elliptical piece of the mucous membrane and submucous tissue in a horizontal direction. The edges readily heal together. The tissue removed should represent the excess only, removal of an excessive mass being followed by disfigurement due to undue recession.

DEFORMITIES DUE TO INJURY.—Burns and scalds are the most prolific causes of labial deformities, ectropion or eversion of the lip being caused by the subsequent cicatricial contraction. The lower lip is usually that involved, and the exposure of the teeth and gums,

the interference with speech, and the dribbling of saliva give the patient a repulsive appearance. This is especially the case when the injury involves the tissues of the chin and neck; the lip may then be drawn over the chin and the latter down to the interclavicular notch or even to the sternum proper.

TREATMENT.—The method recommended by Mr. Teale, of Leeds, is usually resorted to, and is performed as follows: "The everted lip is divided into three parts by two vertical incisions three-fourths of an inch long and carried down to the bone. These incisions are so planned that the middle portion between them occupies one-half the lip. From the inner end of each incision the knife is carried upward to a point one inch beyond the angle of the mouth. The two flaps thus marked out are freely and deeply dissected up. The lateral flaps are now raised and united by twisted sutures in the mesial line and supported, as on a base, by the middle flap, to which they are also attached by a few points of suture, leaving a triangular even surface to granulate." This operation usually gives good results, but it must sometimes be slightly modified to suit the existing conditions.

Excision of Labial Malignant Growths.—The operation is an easy one, a V-incision, including all the mass and brought together with harelip-pins or deep sutures of silk-worm gut, constituting, as a rule, the only procedure required. The wound, properly dressed, usually heals in a week. When the growth has progressed further, all diseased tissues—always including all enlarged glands—should be removed; the operation is necessarily more extensive and perforce less promising. A plastic operation should be subsequently resorted to to form a new lip.

Fricke urges that every ulcerating wart about the lips which resists treatment should be promptly extirpated under local anæsthesia by means of a pair of scissors. When the growth has progressed beyond this stage, every anatomically-related lymphatic gland which is placed in its typical position must be removed. If the glands are not perceptibly enlarged, they are taken out with the surrounding fat. First the glands, then the tumor, is extirpated. This sequence is important. As a rule, the incision should be carried two-fifths of an inch wide of all obviously affected tissue. There were only 3 cases of local recurrence out of 113 operations in which this rule was followed.

When the edges of the new lip are devoid of mucous membrane, the mucosa may sometimes be pulled over the defect from within and stitched to the skin. It should not be forgotten that a lip formed of skin alone, with no internal mucous covering, will shrink enormously when cicatrization takes place.

Macrostoma (Large Mouth).—This is a deformity of the mouth due to failure of the maxillary process to unite with the mandibular process during development. As a result, the slit constituting the mouth is not central, and may be prolonged on the one side of the face so as almost to reach the ear. This condition is often associated with malformation of the auricle.

TREATMENT.—The edges of the buccal opening may be freshened and united, leaving enough of the aperture to constitute a normal mouth. The latter must not be made too small, however, the patient having to undergo a gradual training in the use of the lips in speaking, drinking, etc. In some cases a plastic operation is required.

Cleft Palate.—This condition is the result of imperfect union, during foetal life, of the two horizontal septa which, by their growth, form the partition between the nasal cavities and the mouth. When the posterior portions of the processes fail to coalesce, the resulting triangular slit forms the "cleft."

The extent of the opening varies from a small slit merely separating the uvula into two halves (bifid uvula) to complete central division of the soft and hard palates. In many cases of the latter kind the margin of one of the maxillary processes is fused with the vomer. It may also be associated with harelip on one or both sides, the intermaxillary portion, in the latter case, carrying two or three incisors.

The condition, as is well known, interferes more or less with voice-production, owing to the escape of air into the nasal cavities, and with deglutition, food being sometimes forced into the post-nasal space. During infancy this sometimes represents a dangerous feature, the infant being unable to suck satisfactorily, owing to the inability of the soft palate to close off the naso-oral isthmus during deglutition.

TREATMENT.—The time at which operative procedures should be resorted to depends upon the condition of the child, the extent of the deformity, and the degree of interference with normal feeding. In inextensive clefts the child soon adjust the soft tissues of the mouth to the existing malformation, and finally swallows sufficient food; but an early operation is indicated to avoid imperfect enunciation when he begins to speak. In England it is customary to operate about the fifth or sixth year; in America about the third.

When interference with deglutition is such as to prevent proper feeding of

infants, Mansell-Moullin recommends that a flap be adjusted to the rubber nipple so disposed as to close the cleft when the child has it in his mouth, or if the nipple be long that the opening be on its under surface. The physiological function of the soft palate is thus replaced and the child properly nourished until the operation can be performed.

Provided a cleft of the soft palate is closed before the child has learned to talk, the result, so far as the child is concerned, is perfect. It necessarily follows that the closure of such a cleft should take place somewhere between birth and the end of the second year; within this age limit the later the operation is performed the better. When there is a complete cleft, both of the lip and the palate, operation should be performed upon the lip when the child is about three weeks old, leaving the palate alone until the end of the second year. It is quite remarkable how the closure of the lip influences the subsequent growth of the hard palate. Where the hard palate is involved the subsequent powers of articulation will always be somewhat defective. Murray (Brit. Med. Jour., Aug. 29, 1903).

STAPHYLORRHAPHY.—This operation is somewhat tedious, owing to the difficulty of reaching the parts. The patient should be anæsthetized and the mouth kept open by means of a mouth-gag. Both sides of the soft palate are, in turn, seized with a tenaculum forceps and their edges pared off with a very sharp probe-pointed bistoury. Curved needles held in needle-forceps are then used to introduce the sutures, the best of which is silk-worm gut. Some surgeons prefer silver wire and use tubular needles. The needle is introduced on either side from below, the sutures being made double on one side and single on the other. The latter being passed through the former, the stitches are tied,

after the pared edges have been carefully brought in apposition, just enough to insure union. An important point now is to ascertain whether the parts are under tension. If they are not, the operation proper is finished; if they are, a procedure introduced by J. Mason Warren should be resorted to: *i.e.*, the levator and tensor palati muscles should be divided by pushing a tenotomy-knife through the soft palate, immediately internal to the hamular process and cutting upward until the muscles are severed. The brisk hæmorrhage caused usually soon stops of its own accord. The head may be turned to one side and the mouth swabbed out with ice-water. Blood should not be allowed to trickle down into the larynx.

As soon as the operation is finished the parts should be carefully cleansed by irrigation with boric-acid solution. Only tepid and liquid food should be allowed the first few days and soft food subsequently until adhesion is complete. This occurs in a healthy child at the end of a week, when the stitches may be removed, but it is better and often necessary to leave them longer.

When a small portion of the wound fails to heal, it should be stimulated with the mitigated stick (nitrate of silver and oxide of zinc).

Polauillon performs staphylorrhaphy in two sittings, an interval of twenty-four to forty-eight hours being allowed between the two stages. At the first sitting the usual lateral incisions are made on both sides; the mucous membrane is dissected from each side and loosened from the palatal bones; then hæmorrhage is arrested by compression or hæmostatic forceps. At the second sitting, the edges of the tissues are vivified and very fine sutures introduced. This

operation may be done under cocaine anæsthesia.

Owen detaches the muco-periosteum from the back of the hard palate, in order to gain a slackness of tissue at the anterior part of the cleft in the velum. Tension is further diminished by lateral incisions passing through the soft palate parallel to the line of the sutures.

URANOPLASTY.—When the hard palate is involved the operative technique is somewhat more complicated. If the hard palate alone is fissured, the old procedure advised by J. Mason Warren is still resorted to by most surgeons. It consists in carefully separating the mucous membrane and periosteum from the bone on both sides with the palate-elevator, beginning at the margin of the cleft and extending on each side toward the alveolar process as far as needed. The vessels in the palatine canals must be avoided. The free flaps of membrane thus obtained are then brought together over the opening and sutured. When the soft palate is also cleft, it should be cut from the horizontal edge of the hard palate and the edges of the fissures pared and united precisely as in staphylorrhaphy, including the section of the palatal muscles if required. Sutures are then introduced, the first being inserted at the junction of the hard and soft palate after the flaps have been carefully adjusted in their new position. In some cases—those in which the fissure is not wide—the separation of the soft palate from the hard palate is not required; both edges of the entire fissure are pared, the membrane over the hard palate is raised, and the entire opening is closed by approximating the pared edges and suturing them. The subsequent measures are the same as in staphylorrhaphy.

Ferguson modified the operation by dividing the bone itself on either side

of the fissure and forcing each fragment thus obtained toward the median line. The edges of the fissure are first freshened; holes are drilled through the bony processes near the edge and silver sutures are passed through the openings; a strip of bone is then cut off with a chisel or saw from each side and pressed over to the median line. The sutures are then drawn together and tied. Division of the soft palate downward is necessary. This operation has not obtained much favor among surgeons, though it is a satisfactory one.

A feature of these operations is that much hæmorrhage usually occurs. This can be, in part, prevented, however, by pressing upon the tissues behind the upper incisors: a rather inconvenient procedure. When the periosteum is raised the bleeding is especially profuse, but pressing of the flap against the bone with a sponge arrests it. The descending palatine arteries can be plugged, as shown by Marsh.

In some cases operative procedures cannot be resorted to; obturators constructed by dentists should then be tried.

Rhinoplasty.—Plastic operations are often indicated for deformities of the nose due to the destructive influence of various diseases: syphilis, lupus, or traumas. Occasionally the entire organ has been lost, leaving an unsightly opening; in others the cavities are only partly exposed, through partial destruction of the alæ; while, in others, again, the organ is flattened out or its bridge is on a level with the cheeks: the so-called “saddle-nose.” Two main methods are at our disposal to remedy extensive destruction of the soft parts: the Indian and the Italian, proposed by Tagliacozzi.

INDIAN METHOD.—In this procedure a pear-shaped flap, somewhat larger than needed to make up the aggregate of soft

tissues that would represent a normal nose, is mapped out on the forehead. The flap should lean somewhat toward one of the eyebrows, the narrow portion corresponding to the root of the nose and forming a pedicle one-half inch wide. This being done, the edges of the nasal opening are carefully freshened and leveled, a regular bed being prepared for the flap which is to cover it. The pear-shaped flap is then carefully detached with the periosteum from the frontal bone, twisted down around its pedicle, adjusted to the freshened tissues around the nasal orifice, and so adjusted as to cause a bend in the flap to correspond with what would represent a nasal bridge. Two hard-rubber tubes shaped like the anterior nares should be inserted under the flap so as to preserve patency, and the flap sutured in place. The objection to this operation is that it leaves a scar.

Schimmelbusch, recognizing that only partial cosmetic and functional results are secured in the operation, for the reason that for want of support the new nose gradually sinks and then more and more shrinks, resorts to the following operation: A three-cornered skin-and-bone flap is taken from the middle of the forehead. This flap is so cut out with the knife that the smaller base is at the root of the nose, and the broader side lies exactly in the middle of the forehead. With a sharp, broad chisel the anterior surface of the frontal bone represented by the flap is chiseled off. From the angles of the forehead-defect, large, arched incisions are carried over the skull toward the ears, and the flaps loosened and sutured over the forehead. In this manner simple linear scars remain in the forehead. The loosened flap must first be allowed to granulate, and then it is transplanted upon the

wound-surface. The bone-plate is saved along its middle line and folded together in the form of the nose. This formed flap is then sutured into the freshened wound in such a way that the raw surface stands posteriorly and the skin-surface anteriorly. The septum of the nose is simply obtained from the skin in the deformed nose; so that strips of skin are taken from the sides of the defect as far as the natural position of the septum. The tip of the nose is also formed from the original nose. The first week a silver wire with buttons on either end is passed through the nose at the level of the alæ, and left in place until the separation of the forehead flap and the end of the operation. This helps form the configuration of the alæ by its lateral pressure.

ITALIAN METHOD.—The Italian method consists in utilizing a flap taken from the arm of the patient, over the biceps, at a spot corresponding with the nose when the hand is applied over the head from the front. The flap is so shaped as to assume that of the nose when *in situ*, an allowance of one-third being allowed all around it for shrinkage. It is detached from the arm only partly, however, a pedicle being preserved to insure nutrition of the separated tissues. The flap is left in this condition about two weeks, in order to enable it to become vascular and covered with granulations underneath. At the end of this time the nasal orifice is prepared as for the Indian method; the forearm is placed over the head and fastened there by bandages, and the flap is adjusted to the pared nasal edges and sutured. The patient must remain in this trying position about twelve days, when, the flap having become adherent, the pedicle may be cut and the arm released. The pedicle is then trimmed

off to give it a shapely appearance, and a column is either formed with it or with a small flap taken from the upper lip. The procedure is often successful, but its irksomeness, and the fact that a presentable nose is seldom obtained, cause it to be seldom employed.

In the less marked deformities of the nose, which usually affect the alæ, a small flap may usually be obtained from the cheek, or from the forehead if a large one is necessary. A pedicle should always be left to insure nutrition of the flap while it is becoming adherent to the tissues over which it is applied. If the redundant portion due to the pedicle is in any way unsightly, it may be surgically adjusted as soon as the nasal flap is thoroughly nourished through its new channels. (See SKIN-GRAFTING, vol. vi.)

PLEURA, DISEASES OF. (See also PLEURISY.)

Pneumothorax (Hydropneumothorax; Pyopneumothorax).

Definition.—Air in the pleural cavity is designated pneumothorax. With rare exceptions, fluid, either serous or purulent, is also present; hence the terms hydropneumothorax and pyopneumothorax.

Symptoms.—In the majority of cases the onset is sudden and markedly severe: pain in upper part of the chest, an agonizing feeling of want of breath, rapid feeble pulse, and some cyanosis. The patient may have a sensation of something having given way and of fluid trickling down inside the chest. Any or all these symptoms may be absent. The severity of these symptoms depends chiefly on the functional activity of the lung affected and on the rapidity of the escape of air into the pleural cavity.

If the perforated lung has performed the greater part in respiration the dis-

tress will be extreme and death quickly follow; but if it has previously been much diseased and restricted in function, its loss will be but little felt, if at all perceived. If the escape of air into the pleural cavity is rapid, the urgency of dyspnoea will be much increased, especially if the perforation is valvular, preventing the return of the air into the bronchus and thus increasing the pressure effect of the escaped air.

In advanced phthisis, in which general debility is marked, the respiratory needs are small. In such cases perforation may pass unnoticed, an unsuspected pneumothorax being found at the post-mortem examination. Pain is the most constant symptom in such cases, but it is apt to be attributed to a simple localized pleurisy which occurs very frequently in these cases. This indicates the necessity for careful examination to discover the cause of such attacks of pain in chronic pulmonary phthisis.

As the shock effects pass off the patient may become comfortable, although the respiration continues rapid and may increase in frequency as the air and pleural effusion increase in the pleura. As in tuberculous disease of the lungs, so here, the patient may be breathing fifty times or more to the minute and yet make no complaint of dyspnoea.

In marked cases, especially with increased intrapleural tension, the physical signs are very distinctive.

INSPECTION.—The affected side is large and motionless. The intercostal spaces are obliterated; the cardiac impulse, if visible, is much displaced. The respiratory movements of the opposite side are exaggerated.

By examination of rabbits and dogs in which an artificial pneumothorax had been produced, the blood in the carotid artery was found to contain only half as much oxygen as normal and it is be-

lieved that this diminution of oxygen accounts for the increased respiratory activity. Sackur (*Zeit. f. klin. Med.*, B. 29, '96).

Vocal thrill is absent unless over the site of adhesions of the lung to the chest-wall. The cardiac impulse may be more accurately determined than by inspection. The liver may be found much displaced downward, especially in right-sided pneumothorax. The spleen may be easily palpable.

The note elicited by percussion depends much on the degree of intrapleural tension. In absence of increased tension, the note is highly tympanitic over the whole air-containing cavity and also beyond the sternum, on account of the displacement of the heart and mediastinum. The tympany may be present over the compressed lung, being transmitted through it as it is through the lower part of the liver when the abdomen is highly tympanitic. If the intrapleural tension is high, the note becomes shorter and higher in pitch,—almost dull, in fact,—with decided increase in the feeling of resistance on percussion. In demonstrating such a case recently to my students the note over the tense pleural cavity was found to occupy in quality a position about midway between the markedly tympanitic note over the stomach and the flat note over the liver. On inserting a cannula and allowing some of the air to escape the note became highly tympanitic, and the chest-wall much more elastic. When effusion occurs, the fluid collects at the base of the chest; over its surface the note is flat. The fluid increases freely with changes of position of the patient; so that its surface is always horizontal. The diaphragm may be so much depressed as to contain the fluid in the concavity formed by its upper surface; so that the presence

of fluid cannot be demonstrated by percussion in the erect position.

If the perforation in the lung is valvular and the intrapleural pressure therefore high, compressing the bronchial tubes as well as the lung, no breath-sounds may be audible or only a distant, faint, amphoric inspiratory sound is discernible.

When the perforation is free, the air not being imprisoned and the tension low, loud amphoric breathing may be heard. The peculiar quality is due to transmission of bronchial sounds through a large resounding cavity; the sounds should therefore be heard when the bronchi contain air in free communication with the glottis. The voice, cough, and all adventitious sounds also have an amphoric quality. Metallic tinkling or echo is often heard; it may be produced by any movement, as in respiration, cough, speaking, swallowing, or movements of the heart or of the body.

The bell-sound is produced by striking a coin lying flat on a part of the chest over the air-containing cavity with another coin. A ringing metallic sound is conveyed to the ear or stethoscope applied to the chest anywhere over the cavity.

With air and fluid present, succussion-splash (first described by Hippocrates) may be obtained by shaking the patient or by his making sudden movements as in sitting up or lying down. It may be audible at some distance or only on applying the ear to the chest. It may also convey a shock to the hand placed on the chest.

Analysis of 51 cases of pneumothorax found in the medical records of the Boston City Hospital. Pneumothorax is uncommon. At least 70 per cent. of the cases are tubercular. The prognosis is good when it is due to trauma. It is fair when the pneumothorax is secondary

to abscess of the lung. The results of excision of the ribs in these cases are very encouraging.

Tubercular pneumothorax is much more common in men than in women. It is most frequent in the third decade. It is about twice as frequent on the left as on the right side. The onset is acute in rather less than half the cases. Sudden pain with dyspnoea are the most common initial symptoms. The pneumothorax may be the first symptom of tuberculosis noted.

Recovery from the pneumothorax may occur in about 15 per cent. of all cases. The cases which recover are practically all serious. They usually die later, however, from pulmonary tuberculosis. It is the direct cause of death in 60 per cent. Eighty per cent. of all cases die in less than a year, and only 10 per cent. live over five years. The prognosis is worse in right-sided than in left-sided and in purulent than in serous pneumothorax. It is worse in women than in men. J. L. Morse (*Amer. Jour. Med. Sciences*, May, 1900).

A true pleural effusion has a specific gravity over 1010, usually much higher, with an average of about 1017.9; a high fibrin and albumin content. A pleural transudate has a low specific gravity, with an average of about 1008; a small fibrin and albumin content. An almost certain diagnosis of tuberculous pleurisy can be made by the morphological examination of the fluid alone, and rests on its having a high specific gravity—1012 to 1024, average, 1018.6; a large amount of fibrin and albumin with an accompanying lymphocytosis. There is usually a considerable rise of temperature at the outset, which may average 103.4° F.

According to some authorities, one may find a polymorphonuclear leucocytosis before the third or fourth day of a tuberculous pleurist; in which case, subsequent examinations will be necessary to establish a positive diagnosis. A diagnosis of postpneumonic serous effusion lies in its high specific gravity, averaging 1016.5; large fibrin and albumin content, with a polymorphonuclear leucocytosis, 58 to 92.5 per

cent., averaging 71.7 per cent. The temperature is usually much lower than in the tuberculous cases, unless complicating an active pneumonia, averaging at the outset about 101° F. A differential diagnosis between a pleural transudate and a tuberculous pleurisy cannot rest alone on a differential cell count, as they both show a lymphocytosis, but must rest on a more complete examination, including the specific gravity and the amount of fibrin and albumin, as already shown and explained. H. S. Carter (*Med. News*, Oct. 1, 1904).

Diagnosis.—In cases with the characteristic symptoms—tympany; absence of breath-sounds, enfeebled and amphoric; the bell-sound; the displaced heart; sudden onset, with pain, and urgent dyspnoea—the diagnosis is easily made.

In high intrapleural tension the dull note has not infrequently led to a diagnosis of pleural effusion.

PHTHISIS.—When the lung is largely excavated, with only the thickened pleural sac remaining, the signs closely resemble those of pneumothorax: there is tympany, amphoric breath-sounds, metallic tinkling, and occasionally succussion-splash and the bell-sound. The heart is, however, displaced to the affected side, if displaced at all: a position sufficient to exclude pneumothorax except in presence of very positive evidence.

It may be impossible to distinguish a circumscribed pneumothorax resulting from discharge of an emphysema into a bronchus, or by the extension of a cavity in the lung to the surface, from a cavity lying near the surface of the lung, whether due to tuberculous excavation or to a dilated bronchus.

EMPHYSEMA ordinarily is not likely to be confounded with pneumothorax: it is bilateral, while the latter is unilateral. In cases of fibrosis of one lung the compensatory emphysema of the opposite lung may simulate pneumothorax in physical signs, including displacement of

the heart. But the occurrence of pneumothorax in a case in which the opposite lung is so much crippled in its function would cause the direst distress if the patient survived the immediate effects of the attack.

INJURIES OF THE CHEST.—Diaphragmatic hernia of the stomach and intestines from a crushing injury may closely simulate pneumothorax. The lung would be crowded upward rather than against the spine, and the breath-sounds over it would be exaggerated and not amphoric or suppressed.

A **SUBPHRENIC ABSCESS** resulting from ulceration of the stomach or bowel and containing gas may crowd the diaphragm as high as the third or even the second rib, and present the signs of the presence of fluid and air similar to those of pyopneumothorax. There would, however, be a history of abdominal trouble, harsh vesicular breathing in the lung above the abscess, great downward displacement of the liver, and but little displacement of the heart.

After all, the most common error in regard to pneumothorax is in overlooking its presence in those cases in which its symptoms are absent.

Pneumothorax can be diagnosed by the use of the Roentgen rays. Characteristic for this picture are: Intense clearness over that part of the chest where the air is to be found; below this clear spot is a dark shadow thrown by the exudate; the transverse upper border of this shadow sinks and rises with the respiratory act. Movement of this border can be obtained by breathing, change of position, coughing, and on the left side this movement may be caused by the heart's action. L. Stembo (Deut. med. Woch., July 13, '99).

Etiology.—With the possible exception of the formation of gas in the pleural cavity from the decomposition of exudation, pneumothorax always results from perforation of the pleura and en-

trance of air through the opening. Perforation may take place from disease of the organs within the chest or externally through the chest-wall.

PNEUMOTHORAX FROM DISEASE OF THE THORACIC ORGANS.—Of all the causes, the most common is perforation of the pleura by a tuberculous focus in the subjacent lung. Walshe, Fräntzel, and others of the older writers ascribed 90 per cent. or more to this cause, and recent observers have not altered their estimate. Even in pulmonary tuberculosis the disease is rare, not occurring probably in more than from 5 to 7 per cent. It occurs usually in adults, but is met with also in children, and more frequently in males than females. As pointed out by S. West, perforation generally takes place while the patient is at rest, not rarely during sleep, and in absence of cough or violent respiratory effort. It is worthy of note that these are the conditions in which hæmoptysis also occurs. In both the process is ulcerative, and rupture usually has no part in it.

Of the remaining 10 per cent. the majority are due to ulceration of an empyema through lung-tissue into a bronchus. Next to this is gangrene of the lung. Other causes are abscess and hydatid of the lung or mediastinum, bronchial ulceration, and rupture of an emphysematous vesicle. Osler reports a case due to rupture of an hæmorrhagic infarct in chronic heart disease. Sometimes the disease develops in persons otherwise apparently healthy; many of these are probably tuberculous.

PNEUMOTHORAX FROM WITHOUT may be due to traumatic injury, as in stab wound, fracture of a rib with wounding of the visceral pleura, or in severe injuries of the chest without wound or fracture. It is important to note that pneumothorax follows only in a small number of these

conditions; this is due to the presence of adhesions between the visceral and parietal layers of the pleura and because blood often closes up the perforation or rupture made. Other causes of perforation are abscess in the chest-wall opening both externally and into the pleural cavity, rupture of a cancerous stricture of the œsophagus into the pleura, or perforation of the diaphragm by an abscess resulting from ulcer of the stomach or colon and communicating with them.

Case of pneumothorax and pneumopericardium caused by the spontaneous evolution of gas as the result of the zymogenetic properties of the bacterium coli. Richard May and Ad. Gebhart (Deut. Archiv f. klin. Med., Oct. 27, '98).

Morbid Anatomy.—If the pleural cavity is distended with air its presence is easily demonstrated by introducing a small cannula, when the air will escape with more or less force, as may be shown by its effect on a lighted match or candle. If the air is not under pressure care is necessary in making the autopsy to demonstrate its presence when pneumothorax is suspected. "A simple way is to carefully dissect off the intercostal muscles and expose the pleura in one or more interspaces. If the parietal layer is not thickened the visceral pleura can be seen through it; if it is, the dissection should be continued and a small opening made. There is then no difficulty in observing whether the surfaces were previously in contact" (Fowler).

The heart and mediastinum may be found greatly displaced toward the unaffected side, and the lung partially or completely collapsed. The condition of the pleura varies. If there is no inflammation, the surface presents the normal smooth and shining appearance, but inflammatory changes are usually present and the membrane may be much thickened and its surface covered with a thick

mass of lymph. The lung is often adherent at various points. The cavity often contains much fluid, usually purulent, rarely sero-fibrinous.

Careful search should be made for the perforation; if not readily found it may usually be discovered by forcing air through one of the bronchi. Only one perforation usually occurs, but there may be more, and most often found on the external or posterior surface between the third and sixth ribs. The left side is said to be most frequently affected, but S. West, in eighty-three cases, found the right affected in forty-one. The size of the opening varies, usually small at first and enlarging if the patient survives. It may be direct or valvular. If direct the air enters and escapes freely during respiration, the lung usually collapsing completely. If valvular the air enters freely, but cannot escape in expiration; thus the cavity becomes fully distended during inspiration. Then by expulsive expiratory efforts, as in straining and coughing, air is forced into it until the tension becomes as great as that of the intrathoracic air during the most violent of these efforts. Thus, the side becomes greatly enlarged, the mediastinum and heart forced to the opposite side, and the diaphragm pressed downward until possibly the whole liver appears below the costal margin.

The lung is usually tuberculous, and it is in the acute forms that perforation usually occurs. Caseous foci near the surface of the lung break down and necrosis of the overlying pleura may occur before inflammatory adhesion to the parietal surface takes place. In chronic cases, the process being gradual, adhesions of the pleural surfaces occur before the destructive changes reach the surface.

The composition of the air in the pleural cavity when it gains entrance

through a punctured wound in the chest is the same as that of the external air; when it enters from a perforation in the lung it consists of the same constituents as that in the alveoli; and when it has laid long in the cavity, its exit being cut off, the oxygen is absorbed and carbonic acid and nitrogen increase, and, in foetid cases, sulphuretted hydrogen is also present.

Prognosis.—The prognosis depends on the cause and the circumstances under which the pneumothorax develops. It is favorable in apparently healthy individuals, the air being absorbed without the development of pleurisy. In traumatic cases the prognosis depends chiefly on the nature of the injury.

In tuberculous cases the prognosis is grave. The complication occurs usually in those in whom both lungs are affected with the acute caseating types of the disease. Much depends on the condition of the opposite lung; if it is only slightly diseased and the general condition good, recovery may take place, with absorption of the air and fair expansion of the lung. With extensive disease of both lungs a rapidly-fatal result is the rule. In thirty-nine cases collected by Sir R. Douglas Powell the average duration was twenty-seven days. In some cases, however, the condition becomes chronic and the patient is able to go about with a fair measure of comfort. Arrest of the tuberculous process sometimes follows the occurrence of pneumothorax, but it does not necessarily follow.

One hundred and sixty cases of pneumothorax collected, of which 104 died, giving a mortality of $62\frac{1}{2}$ per cent. The mortality in those cases in which the pneumothorax developed in the hospital was much higher (77 per cent.) than in those admitted some time after the condition has been established (33 per cent.). This is explained by the fact that the proportion of deaths is much

greater during the first week than at any subsequent period. Death is due to either rapid suffocation or shock within a very short period after the rupture, or as a result of effusion, or as a result of the disease-process which produced the pneumothorax, usually phthisis. The prognosis depends upon (1) the urgency of the symptoms—that is to say, the amount of dyspnoea and cyanosis; (2) the condition of the opposite lung, the development of râles being a very bad omen; (3) the ability of the right heart to overcome the increased resistance in the pulmonary circulation, any sign of dilatation being unfavorable; (4) the general strength of the patient, particularly the development of the respiratory muscles; (5) the nature of the disease which has led to the pneumothorax. Recovery from the disease is rare, but it may occur and may be apparently complete and permanent. The most favorable cases are those in which there is no pulmonary disease and in which no effusion has taken place. If the effusion does occur, but is purely serous in character, the prognosis is also good. S. West (*Lancet*, May 8, '97).

From study of recurrent idiopathic pneumothorax without effusion following conclusions are reached:—

1. That simple or idiopathic pneumothorax is a very rare disease of the lungs and pleura.
2. That a repetition of the disease in the same lung is of still greater rarity.
3. That in a very small number of cases the entrance of air into the pleura—to stretch it to its utmost limits—does occur without any effusion of fluid; and this even may happen a second time in the same lung.
4. That the absence of fluid renders the disease less fatal than when air and fluid are effused.
5. That the presence of air in the pleura may occur without any febrile or constitutional disturbance.
6. That in the face of such possibilities we should be cautious as to giving too grave a prognosis when evidences of a ruptured lung and pleura are present, and particularly so when there is no previous disease.

7. That the tendency of such cases is toward spontaneous recovery, and, in the absence of urgent symptoms calling for relief, it is wiser not to employ surgical means to let off the effused air. J. M. Finny (Dublin Jour. of Med. Sci., Apr. 1, '98).

Treatment.—In most cases this can only be palliative. If the onset is sudden, with severe symptoms, morphine should be given subcutaneously for the relief of the pain and dyspnoea, and to soothe the mental distress. Stimulants are usually needed to counteract the prostration. If the cyanosis and dyspnoea be great, dry cupping may give some relief. For the pain caused by the pleurisy that usually follows three or four leeches may be applied, followed by hot fomentations, after which the chest may be strapped.

While the serious phenomena met with in acute traumatic pneumothorax vary in intensity according to individuals and circumstances, and in some cases are so slight that they may be disregarded, it is the duty of every surgeon whenever he is about to undertake an operation on the chest or neighboring region which might involve the pleura, to assume that sudden admission of air into the pleural cavity is inevitable and he must be prepared to meet the evil effects of acute atelectasis.

The procedure that promises the most benefit in preventing pulmonary collapse in operations on the chest is artificial inflation of the lung and rhythmical maintenance of artificial respiration by means of a tube in the glottis directly connected with a bellows. The best means hitherto used for inflating the lung in cases of acute traumatic pneumothorax is afforded by a bellows devised by Fell by which air is passed through an O'Dwyer intubation-tube inserted, as in cases of diphtheria, into the glottis. Matas (Annals of Surg., Apr., '99).

In most cases the question of paracentesis has to be considered. If the pressure within the chest becomes great and the dyspnoea urgent in consequence, a

small cannula should be passed to allow air to escape. The operation must be done with the most careful antiseptic precautions. The lowering of the intrapleural pressure may be followed by the reopening of the perforation if it had become sealed with lymph; but if the distress is urgent even this risk must be taken. Following the removal of the cannula there is a liability to subcutaneous emphysema; this may be avoided by making pressure on the puncture for a short time after withdrawal of the cannula.

In tuberculous cases with purulent pleural exudate the course may be chronic without marked disturbance. Such cases had better be left alone. Aspiration is only followed by temporary relief, and free incision with drainage results in improvement for a time, but as the lung usually does not expand decomposition of the exudate takes place and sepsis is produced. In many, greater activity of the tuberculous process is also excited. If the amount of fluid becomes great, we must interfere. Aspiration should first be tried, and repeated from time to time as necessary, usually more active measures must be adopted. Godlee recommends passing two aspirator-needles into the chest, one in front and the other below the angle of the scapula. To the anterior needle tubing is attached, which passes into a bottle of sterilized boric-acid solution,—temperature, 100° F.; to the other needle the aspirator is attached; as the fluid is drained off from the back of the cavity, the patient lying on his back at the edge of the bed, the boric-acid solution enters through the anterior needle. The aspiration is continued until the solution comes away quite clear, when the anterior needle is removed and the chest emptied by the aspirator as far as possible.

If the liquid is foetid, incision and free drainage offers the best, if not the only, hope of relief. A young man whom I saw several years ago seriously ill with this condition was able, shortly after free drainage was effected, to walk a few miles daily and attend to a little business for some months, dying ultimately of the tuberculosis, but relieved of the sepsis. Such tuberculous cases, however, rarely recover, succumbing usually to the tuberculous infection; but it seems better that they should die without, than with, the pleural cavity full of pus. As in empyema, ribs may have to be resected, and pulmonary gymnastics should be persistently practiced to secure re-expansion of the lung.

The position of the patient with the sound side upward is of great importance during anæsthesia in pyopneumothorax. Two cases have been recently recorded in each of which death followed the turning of the sound side of the patient upward to facilitate operative procedures, death being due to a flow of pus into the bronchial tubes of the sound lung. Bowles (Med. News, Jan. 8, '98).

Hydrothorax.

Definition.—The occurrence of a serous transudation into the pleural cavity apart from inflammation is termed *hydrothorax*, or *dropsy of the pleura*.

Symptoms.—The symptoms are those resulting from interference with respiration. They are usually attributed to the primary disease, and the hydrothorax is overlooked, often from want of examination on account of the weakness of the patient. In all cases of increasing dyspnoea, cyanosis, and prostration the chest should be examined for pleural dropsy, as removal of the fluid may relieve the symptoms and afford the patient a chance of recovery.

Though most authors state without reservation that inflammatory pleural effusion is distinguishable from hydro-

thorax by its unilateral character, the preliminary symptoms, and the fever, some—as Leube, Pepper, and Osler—have very properly insisted that hydrothorax may be unilateral and unattended by external œdema; and, on the other hand, that inflammatory pleural effusion may be latent; that is, unaccompanied by the usual symptoms. A knowledge of the possibility of hydrothorax of this character is of clinical importance, though, even with the full recognition of this possibility, difficulty may occasionally arise in determining whether an effusion is dropsical or inflammatory.

In some cases a unilateral hydrothorax is chronic in character, and the fluid, after repeated tapping, increases in specific gravity. In such instances it may be that a secondary inflammatory exudation has been added to the dropsical effusion. Alfred Stengel (Univ. of Penna. Med. Bull., June, 1901).

The *physical signs* are those of pleurisy with effusion, but somewhat modified, on account of the absence of fibrinous layers on the pleural surfaces. There is less distension of the side. Vocal fremitus is absent. The breathing may be bronchial on account of collapse of the air-vesicles; it is usually faint. On light percussion the note is dull. There is no friction rub. Frequently there is a crepitant râle over the upper part of the effusion and above it, owing partly to expansion of collapsed vesicles and partly to œdema of the lung-tissue.

Etiology.—Hydrothorax occurs in a variety of conditions from obstruction to the venous and lymph outflow. The great majority of cases occur as a part of general dropsy, especially in cardiac failure, emphysema, and renal disease. In both the latter cardiac failure with anæmia plays the chief part in the causation of pleural dropsy. Mediastinal tumor, by pressing on veins, may also give rise to it.

The amount of exudation into the various cavities varies greatly and for

this no satisfactory explanation can be offered. In heart disease the dropsy is often limited to one pleural cavity; in renal disease both are usually affected. An intrathoracic tumor may cause dropsy on one or both sides, from pressure on the azygos veins.

Morbid Anatomy.—The effusion is a clear straw-colored fluid, rich in albumin usually,—richer than the dropsical fluids of the pericardium, peritoneum, or subcutaneous tissues. This has been attributed to the suction-action of the pleural cavity excited by the retractile energy of the lung.

In recent exudation the pleura is normal in appearance, but after a time it loses its glistening appearance on account of the formation on its surface of a fibrous film which can be peeled off. This is probably due to slight inflammation from prolonged contact of the fluid. The lymphatics of the pleura may form a visibly-dilated net-work. The lung is more or less collapsed, and in cases of long standing requires considerable pressure to expand it.

Treatment.—The treatment should be directed chiefly to the cause. If we can restore the equilibrium in the circulation in the cardiac cases the dropsy will soon disappear. When the presence of fluid can be demonstrated, it should usually be aspirated, as its removal relieves the heart; or at least sufficiently to enable it to recover compensation, especially if, at the same time, the right ventricle be relieved by venesection. Digitalis and similar remedies then become effective, although previously their administration was without benefit.

Hæmothorax.

Symptoms.—The symptoms are those of hæmorrhage, and if the escape is rapid and large there will be dyspnoea

in proportion to the pressure on the lung.

The symptoms are those of pleural effusion without fever or friction. The percussion-note is absolutely flat if coagulation in even a thin layer takes place.

The diagnosis is based on the signs of loss of blood, accompanied with those of rapid accumulation of fluid in the pleural cavity.

Etiology.—Hæmorrhage into the pleural cavity may occur from a variety of causes. In traumatic cases there may be rupture of an intercostal or mammary artery, or laceration of the lung. Rupture of an aneurism of the aorta occurs not infrequently into the pleural cavity. Occasionally rupture of an aneurism of the internal mammary occurs, and in rare cases there is an intrathoracic rupture of a vein into the pleural cavity. Rarely bleeding takes place from rupture of a pulmonary infarct, and of a phthisical cavity into the pleura at the same time that a vessel is lacerated. Bleeding may also occur in scurvy and in purpura.

Prognosis.—The outcome depends on the cause of the bleeding, its amount, and the possibility of reaching the bleeding point by surgical means. In traumatic cases there is early coagulation; the serum is rapidly absorbed; but the clot is long in disappearing. If infection occurs, suppurative pleurisy follows.

Treatment.—This is purely expectant unless the bleeding-point can be located and secured. Great caution should be exercised in operating when the source of the bleeding is not known. If there is urgent dyspnoea some of the blood should be removed by aspirating.

Any patient who has suffered from simple pleural hæmatoma not demonstrated as tubercular should be submitted to severe hygienic measures and close surveillance of the respiratory apparatus. Mesnil (Thèse de Paris, '94).

Chylothorax.

This condition is often designated by the name "chylous pleurisy," but incorrectly, as there is no inflammatory process present. A similar collection may exist in the peritoneum.

Symptoms.—The symptoms are such as are caused by non-inflammatory effusion. Pain may be caused by distension of the pleural cavity. Aspiration of the fluid determines the diagnosis, but there may be difficulty in withdrawing the fluid.

Etiology.—It is usually caused by obstruction of the thoracic duct or the receptaculum chyli, but may be due to rupture of either of them. In many cases the seat of lesion cannot be found at the autopsy. The obstruction may be caused by a cancerous growth or a tuberculous deposit.

In case of chylous pleurisy at the necropsy the abdomen was found to contain about 5 ounces of milky fluid and the right pleura 2 pints. In the left pleura there was a pint of turbid serum, with some fat held in suspension. The thoracic duct was dilated in its whole extent, and was blocked at its outlet by thrombosis of the internal jugular and subclavian veins limited to that spot. The liver appeared normal. The general glandular enlargement was due to infiltrations with carcinomatous deposit secondary to scirrhus of the pylorus. Turney (*Lancet*, May 20, '93).

Prognosis.—The outlook is very unfavorable, but the course depends much on the nature of the primary lesion. Probably none recover, death usually occurring in six to ten months.

Treatment.—The fluid should be removed by the aspirator as often as its accumulation causes pain. Nothing more seems feasible.

New Growths of the Pleura.

Most of the new growths occurring in the pleura are secondary to deposits elsewhere. The majority arise by direct in-

vasion from a primary lesion in the lung, but they may follow disease elsewhere, especially of the mammary gland.

Of the primary growths, carcinoma is the most common, but sarcoma and fibroma also occur.

Symptoms.—The clinical history presents great variety. Pain may be absent, slight, or severe. Loss of strength and flesh occurs, but emaciation is rare. Usually there is dyspnoea and cough. In diffuse cancer of the pleura secondary to primary cancer of the lung the pleural symptoms may so predominate that the lung disease is lost sight of. There is marked dullness and weak fremitus and breath-sounds. In the majority of cases the signs point to marked pleural effusion with displacement of the heart and enlargement of the side. In some cases, however, marked retraction takes place.

The course is usually rapid, death occurring in a few months.

Diagnosis.—New growths of the pleura can rarely be distinguished from other forms of pleurisy—chronic tubercular, especially—until well advanced. The effusion is usually blood-stained, and the characteristic elements may be found with the microscope.

Case of pleural effusion in which the exudate was examined, a diagnosis of spindle-celled sarcoma of the pleura made, and diagnosis was confirmed post-mortem.

The exudate contained groups of typical spindle cells, as differentiated from the flat cells of the endothelium commonly found in pleural exudate and also differing from the irregular spindle cells found in plastic pleurisy. R. S. Warthin (*Med. News*, Oct. 16, '97).

Morbid Anatomy.—The primary carcinoma is usually of the endothelial type. In most cases there is much thickening of the pleura, more of an inflammatory character than of new growth. The origin of the growth is uncertain, but

probably from proliferation of the epithelium of the primitive body-cavity.

The pleural cavity usually contains much bloody fluid. There may be metastasis to other organs, and the growth may appear in front of the ribs and infiltrate the superficial structures. This was the case in a man whom I saw last year. His left chest was contracted and a large area of its anterior surface much indurated by cancerous deposit.

Treatment.—As the condition is absolutely unamenable to treatment, nothing can be done but relieve the distressing symptoms as far as possible. Paracentesis is usually followed by rapid reaccumulation of the fluid.

Echinococcus of the Pleura.

This affection is very rare, being met with primarily in the pleura in probably less than 1 per cent. of all cases; as a secondary infection, especially from the liver and lung, it is somewhat more frequent.

The cyst is usually single, growing inward from any part of the pleura. It compresses the lung and gives rise to the signs of a circumscribed pleural effusion of which the outline may be irregular. In a few cases it grows outward and causes bulging of the chest-wall and may perforate it, causing a chronic fistulous opening.

The cyst-wall is formed externally of the much-thickened and dense pleura and internally by the laminated membrana propria of hydatid cysts. The fluid contents are clear, though rarely they may become purulent from secondary infection.

As in hydatids of the liver, so here, the health may continue good. Pain, however, may be an early and persistent symptom. Pressure symptoms are added as the cyst enlarges, and the lung becomes compressed and the heart dis-

placed. The temperature is normal unless inflammatory symptoms develop. Anæmia and loss of flesh may become marked. Occasionally there is hæmorrhage into the pleural cavity.

Diagnosis.—The diagnosis is usually difficult. The true nature of the condition may be suspected from the evidence of a growing cyst without fever. There may be pain and loss of flesh. Tactile fremitus is absent. Circumscribed pleurisy and new growth will cause similar symptoms, but may be differentiated by puncture and careful examination of the fluid for hooklets.

Treatment.—If left to run its course it usually terminates fatally. In the treatment simple aspiration is rarely sufficient, while free incision with liberal resection of ribs, if done early, rarely fails to effect a complete cure.

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PLEURISY.—Inflammation of the pleura may occur as a *primary* affection, or, perhaps more frequently, it is *secondary* to a general or local disease.

Acute Pleurisy.

Symptoms.—In many cases of acute pleurisy the onset is insidious; it is usually so when it occurs secondarily to some grave disease whose symptoms mask those of the pleurisy. It is usually latent also when it occurs late in such exhausting diseases as carcinoma, nephritis, and tuberculosis.

Ordinarily, however, an attack of pleurisy sets in with slight shivering followed by fever and pain in the side. In some cases there is an abrupt chill, especially in pneumococcal pleurisy, which may closely simulate pneumonia. In children the chill is usually replaced by vomiting, sometimes by a convulsion.

Pain is the most distressing and constant symptom; it usually occurs in the neighborhood of the nipple or in the axillary region. It may, however, be referred to the back or to any part of the abdomen. So severe and circumscribed has it been in the abdomen that a diagnosis of appendicitis has been made and an operation performed. The pain ordinarily is sharp and excruciating, aggravated by respiratory movements and cough. It is usually relieved when the effusion becomes sufficient to separate the pleural surfaces, but in severe cases it may persist and be felt in the distribution of the intercostal nerves in the abdomen. There is tenderness along their course and there seems no doubt that the pain is due to extension of the inflammation to the perineural sheaths, possibly to the intercostal muscles in some cases.

Cough is an early symptom, being worse usually in the early stage. It is short, dry, and, as it increases the pain, is repressed as much as possible. There may be slight mucoid expectoration on account of associated bronchitis. The temperature for the first week or ten days usually rises to 101° or 102° F.; in the pneumonic type it may be as high as in pneumonia, with an incomplete crisis followed by a second rise. It generally, however, declines by lysis in about ten days, but the fever may persist for weeks, taking on a hectic character even in sero-fibrinous cases, suggestive of suppurative exudation. Such cases are probably tuberculous.

The pulse is moderately quickened. The pulse-respiration ratio does not undergo the marked change so characteristic of pneumonia. The respiration is increased in frequency at the outset on account of the pain and later on account of the bulk of the exudate. The effect of the effusion on the respiration depends

much on the rapidity of its accumulation,—a rapid exudation causing much dyspnoea, while one slowly formed may produce no conscious disturbance so long as the patient is quiet, although the pleural cavity may be moderately distended. In the early stage the decubitus varies, but when the effusion becomes copious the patient usually lies on the affected side.

PHYSICAL SIGNS.—These depend chiefly on the nature and amount of the exudation. (a) In pleurisy with recent fibrinous exudation on inspection the movements of the affected side are seen to be restrained on account of the pain; the expansion may be jerky. The patient often lies with the body bent toward the affected side. On palpation vocal fremitus is usually unaffected unless the exudation is abundant, when it is lost. Occasionally friction-fremitus can be felt.

Percussion may yield negative results, or there may be somewhat diminished resonance, owing to lessened expansion of the lung and the considerable amount of plastic exudation.

For the same reasons, on auscultation the breath-sounds are weak or even absent. Friction-rub may be heard and is the diagnostic sign. When well defined it is heard as a to-and-fro sound in inspiration and expiration. It may be heard in deep inspiration only. Usually in children and not rarely in adults it is absent. It may be heard only in small areas,—in the inframammary or axillary region,—and is therefore liable to be overlooked. It is formed by a succession of superficial creaking or rubbing sounds, but may resemble a crackling râle. It lasts but a few hours in cases of rapid effusion. In pleurisy in the neighborhood of the heart a friction-sound of cardiac rhythm may simulate pericardial friction.

(b) In pleurisy with effusion inspection also furnishes valuable assistance. If with the occurrence of effusion separating the pleural surfaces the pain is relieved, the chest-movements become more free. However, as the fluid increases the expansion lessens and disappears if the effusion becomes large, while that of the unaffected side increases. The intercostal depressions become widened and obliterated, giving the chest a smooth, rounded appearance with increase of the antero-posterior diameter. In large effusions the mediastinum is displaced toward the sound side, most markedly so in effusions into the left pleura. The position of the cardiac impulse is the best index to the degree of mediastinal displacement, and therefore of the amount of pleural effusion. It may appear at the left axillary line or as far to the right as the right mammary line. The downward displacement of the diaphragm is measured by the position of the liver and spleen, the lower borders of which may be at or below the umbilical line.

In acute inflammation of the pleura we not infrequently have abdominal pain. This is sought to be accounted for in various ways. One is that the lower six intercostal nerves supply not only the pleura, but also the abdominal muscles; hence the pain could be readily referred to the abdomen. Again, the phrenic nerve may play some part in this peculiar condition. This referred pain may give rise to the diagnosis of appendicitis, cholecystitis, etc., when the real lesion is a pleurisy or a pneumonia. The writer gave the histories of several cases in which a mistake in diagnosis had been made in some in which appendicectomy had been done under a wrong apprehension. In children it appears not necessary that the lower lobes of the lung be affected to cause this referred pain, as it may occur when the pneumonia is apical. J. B. Herrick (Amer. Medicine, May 16, 1903).

The important sign of liquid effusion on percussion is the flat note and the increased, or "board-like," resistance over the whole surface of effusion. This loss of resonance and elasticity is due chiefly to the liquid in the pleural cavity, but partly also to the collapsed state of the lung beneath the fluid. The dullness extends from the base upward, usually highest in the axilla and sloping somewhat lower to the front and back. When the effusion rises higher than the angle of the scapula the lung will have relaxed to such a degree as to give a tympanic note above the nipple: the Skodaic resonance. Posteriorly the note is usually somewhat impaired far up the back. The level of the fluid is usually altered by a change of position of the patient. On this point, however, different observers report different results. Possibly in moderate effusions the fluid changes gradually with change of position of the patient if there are no adhesions. In some cases, in which the effusion has formed in the recumbent position, the area of flatness corresponds with the surface of the lower lobe of the lung; but in some of these the exudate is almost wholly fibrinous. The lower limit of flatness on the right side passes into and cannot be distinguished from liver-dullness; on the left extends to and, in large effusions, it obliterates stomach-resonance: Traube's semilunar space.

In pleurisy with effusion appearances vary according to the amount of fluid contained in the pleural cavity, and naturally upon the position of the patient. The greatest difficulty in the discrimination of fluid in the chest is met with in children. Here, therefore, radioscopy is of the very greatest service in giving aid to clinical signs. The chief points to note in conducting such an examination are: (1) The height of the fluid on the affected side; (2) the contour of the upper margin of the

fluid; (3) whether or not the outlines of the ribs can be distinguished; (4) the position of the heart, and (5) the movement of the diaphragm if this be visible. The conclusions that the author has reached by means of radioscopy are as follows: (a) The level of the fluid changes with the position of the patient unless the quantity of fluid be great or it be encysted by adhesions; (b) that a purulent effusion yields the shadow of greater density than a sero-fibrinous effusion; (c) that the shadow is homogeneous, and in the case of serous effusion gradually increases in density from above downward; (d) that, however far the heart be displaced to the right, in most cases little alteration takes place in the position of the apex relatively to the base; (e) that other conditions being equal, the heart is displaced more when the effusion is left-sided, and (f) that a somewhat triangular shadow, not normally visible, above and continuous with the shadow of the heart and pericardium, is cast by the mediastinum, which is displaced by the lateral pressure toward the healthy side of the thorax. J. F. Halls Dally (Lancet, Feb. 27, 1904).

Vocal thrill is at first weakened and later, with increase of exudation, lost over the area of dullness. In rare cases it remains unaffected, especially in children. This may be due to conduction of vibration from the spine along the ribs.

As regards auscultation, for the first few hours or more, before the effusion is sufficient to separate the pleural surfaces, a friction-rub may usually be heard over the affected area. The rub is a to-and-fro sound heard in inspiration and expiration, but may be heard only on deep inspiration. It is superficial, being quite close to the ear, and has a creaking quality; more often, owing to the exudate containing much serum from the first, the friction is soft and crepitant, resembling the crepitation of pneumonia. Friction often returns as the fluid is ab-

sorbed and the surfaces come into contact again.

The respiratory sounds are weak or absent below the level of the exudate, but often in children and occasionally in adults tubular breathing is audible all over the dull area, especially if the pleural cavity is so full as to collapse the lung, but not to compress the bronchi. Only a puffing expiration of amphoric quality may be present, or the breath-sounds may be intensely amphoric or cavernous and may lead to a diagnosis of cavity, or pneumothorax.

Vocal resonance is usually weak or absent over the effusion. Like the breath-sounds, it may also be bronchial. In moderate effusions there may be ægophony, heard most commonly about the angle of the scapula. It is not a sign of importance, because it is often absent in this and present in other affections. The whispered voice, it is said, may be clearly transmitted through serous, but not through purulent, exudations (Bacelli's sign). It is, however, in some cases transmitted through purulent exudations.

The coin sign is obtained by laying a coin on the front of the chest and striking it with another; the ear placed at the back of the chest has transmitted to it in some cases a clear metallic sound, if a pleural effusion is present.

PUNCTURE.—Exploring the chest with the aspirator affords the most positive means of determining the existence of fluid and its character. If the needle is absolutely aseptic and the part of the chest to be punctured carefully disinfected, aspiration may be resorted to with impunity in all cases. Certain errors have to be guarded against in exploring the chest with the aspirator. The exudate may be capsulated and the needle pass to one side of the cavity. The

pus may be too thick to enter a needle unless of large calibre; for this reason a large needle should, as a rule, be used, especially as it causes but little more distress than a small one. Even a large needle may be plugged by the false membrane in piercing it, so that no pus can pass. In such a case the suction should be cut off and the needle withdrawn, when the plug of purulent fibrin will be found in the needle and confirm the diagnosis. The needle may enter a purulent cavity in the lung resulting from tuberculosis, pneumonia, actinomycosis, etc. It may draw off pus from a subphrenic abscess, from a purulent pericardial exudate, or from a bronchial tube.

PULSATING PLEURISY is a rare phenomenon. Sixty-eight cases have been collected, mostly on the left side, and only one was sero-fibrinous, the rest being purulent. The impulse may be heaving and limited to the sternal region, or diffused and most marked in the axillary and scapular regions. In some of the cases pulsation did not occur until perforation of an intercostal space led to the formation of an abscess-sac beneath the skin,—*empyema necessitatis*,—the pulsation being confined to the subcutaneous abscess.

Interlobar pleurisy is much more frequent than is ordinarily supposed. The x-rays have considerably facilitated the diagnosis of this condition. Ten cases personally observed. It is frequently confounded with gangrene of the lung. Sciagraphic examination gives the same results in cases of interlobar pleurisy and of aortic aneurism. Béchère (Gaz. Heb. de Méd. et de Chir., Feb. 2, '99).

Course and Termination.—The affection presents a very variable course. In dry pleurisy the inflammation may rapidly subside and recovery take place in a few days. In some there is persistence of pain for some time and fresh attacks in other parts of the pleura. In these

the pleurisy is secondary to other affections, chiefly pulmonary tuberculosis.

In cases of sero-fibrinous effusions the fluid may increase for a week or ten days, when, the active process ceasing, absorption sets in and rapid recovery follows. Or absorption may not begin until after the lapse of a stationary period of indefinite duration. Recovery is rarely complete in less than a month; in cases of considerable effusion it requires a much longer time, especially if aspiration is required. Absorption rarely begins during the continuance of the fever.

A sero-fibrinous effusion may persist for months, especially in tuberculous cases, notwithstanding repeated aspirations. Sero-fibrinous pleurisy is rarely fatal, yet excessive effusion is not without risk. Even though the effusion causes little discomfort while the patient is at rest, sudden death is liable to occur, especially on exertion. Death may be due to thrombosis or embolism of the pulmonary artery, to clot in the right ventricle, to degeneration of the heart, or to œdema of the uncompressed lung. Displacement of the large thoracic vessels with compression, especially of the inferior vena cava, has been regarded as a cause, but at most is only an improbable one. Dullness often persists after the effusion is absorbed. It may be due to unexpanded lung or to copious fibrinous exudation. It may persist throughout life.

Retraction of the chest sometimes follows absorption; it may be local or general.

In purulent cases the duration is much prolonged. The exudation is occasionally absorbed when due to the pneumococcus; but this is rare and never occurs in streptococcal cases. Left to itself, the exudation may discharge by external rupture, by rupture through the lung, or into some other cavity or organ. With

early and effective drainage recovery may be complete without any retraction of the chest or impairment of expansion. Such results have been obtained even after the exudation has existed for six months or more. The degree of interference with expansion of the lung, and consequently of retraction of the chest, is determined by the amount of thickening of the visceral pleura resulting from organization of adherent lymph or from changes in the pleura itself and subjacent lung-tissue. The defect may be compensated for by enlargement of the upper part of the affected lung as well as of the opposite lung; so that dyspnoea does not result. Bronchiectasis sometimes develops in the contracted lung, and may affect the opposite lung also.

In neglected cases the pus will usually in time perforate the chest-wall: *empyema necessitatis*. The opening most commonly occurs in front in the fifth interspace, where the chest-wall is thinnest, but it may take place anywhere from the root of the neck to the buttock. The course in such cases is very tedious,—often the opening never closes. In a young girl under my own observation it lasted eleven years. There was extreme retraction of the chest. Rupture may also take place into the œsophagus or the pericardium. The diaphragm may be perforated and the pus discharged into the stomach, intestine, gall-bladder, or even the pelvis of the kidney. Or it may pass down the spine and appear as a psoas or lumbar abscess.

Perforation of the lung may occur and lead to the rapid discharge of pus through the bronchi. The discharge may be so rapid as to suffocate the patient, but the discharge may be gradual and recovery ultimately follow. Air usually gains access to the sac: pyopneumothorax.

In some cases, especially those of

tuberculous character, the pus may cause more or less extensive superficial necrosis of the lung and be gradually filtered through spongy lung into the bronchi. In these pneumothorax does not follow. In some cases the opening into the bronchi is valvular, and the pus is then discharged intermittently.

Perforation of the lung rarely takes place before the empyema has existed six weeks or more. It may occur after free drainage has been established by operation, or spontaneous discharge through an intercostal space has occurred. Or the perforation of the lung and discharge through the bronchi may precede the intercostal perforation. This occurred a year or two ago in a man who had a circumscribed empyema from perforation of the diaphragm by an appendiceal abscess.

Nowadays all such terminations, fortunately, are rare, as necessary operations for the discharge of the pus are usually done early.

Diagnosis.—Though the diagnosis of pleurisy is usually easy, perhaps no disease within the thorax is more frequently unsuspected. The difficulties belong chiefly to the earliest and the latest stages. In the earliest the symptoms may be latent and thus render the diagnosis impossible. In acute dry pleurisy, if the friction-rub is present, the disease is easily recognized. If the rub is absent, it may be difficult to distinguish it from pleurodynia and intercostal neuralgia. In these latter affections there is no pyrexia and the tenderness is more marked along the course of the nerves than in pleurisy. In doubtful cases careful repeated examination should be made over the area of pain, lest effusion occur and be overlooked and do much damage.

In the later stages when the effusion is abundant, the diagnosis may be very difficult. In this condition the diagnosis

is based upon the enlargement and immobility of the chest, dullness with loss of elasticity over the dull area, absence of vocal thrill, weakness or absence of respiratory sounds, and the displacement of the cardiac impulse toward the unaffected side. Of these signs the cardiac displacement is the most important: it, in fact, furnishes the key to the condition.

If there be high-pitched tympanitic resonance below the clavicle, it is very characteristic of fluid below. In moderate effusions these signs may be wanting or indefinite, and the case may closely simulate pneumonia. This history of initial chill, the rapid rise of temperature, the dyspnoea, the rusty sputum, and the dullness without the wooden character usually serve to differentiate pneumonia. But pleurisy, especially that due to the pneumococcus, may simulate this history closely: there may be the initial chill, rapid rise of temperature, dyspnoea, tubular breathing, with high-pitched expiration, all these without displacement of the heart.

An early symptom of pleurisy with effusion noted in nineteen cases consisted in a narrowing of the intercostal spaces and increased rigidity of the intercostal muscles on the affected side. It is especially marked in children and is due to abnormal contraction of the interosseous muscles analogous to the muscular contraction which occurs in joint affections. Przewalski (*Amer. Medicine*, May 31, 1902).

In case of doubt as to the presence of effusion, exploring the chest with the aspirator usually determines the character of the case. With extreme care as to aseptic precautions there is no risk in exploring the base of the chest; in the rare cases of localized exudation at the apex there is some danger of wounding the large vessels. Not infrequently, however, puncture fails on account of the

situation of the fluid—as in diaphragmatic pleurisy, its circumscribed character, or its density.

A large pericardial effusion is sometimes difficult to distinguish from left-sided pleural effusion. The position of the cardiac impulse is the most important guide; it is not displaced to the right in pericardial effusion. The heart is feeble and the impulse weak and may be diffuse.

In pleurisy the impulse is commonly easily felt unless it is behind the sternum and the heart-sounds are strong. In large pericardial effusion there is marked dyspnoea and a peculiar cyanotic hue of the general surface. In the left axilla the percussion-note is Skodaic unless obscured by associated pleural effusion. In the latter case removal of the pleural effusion is not followed by due relief and the cardiac impulse is not affected.

On the right side subphrenic abscess or hydatid cyst of the liver may force the diaphragm high in the thorax and be mistaken for pleural effusion. The upper limit of dullness is usually arched and in some cases a friction-rub is present over all parts of the tumor: a sign that should arouse suspicion. Then there is fullness and a feeling of tension in the hypochondrium; the liver is sometimes depressed, but it may be in pleural exudations also. On introducing a cannula the pus is forced out during inspiration in subphrenic abscess, in pleural effusion during expiration.

Hydrothorax presents all the signs of pleural effusion, and intrathoracic tumors may simulate and often give rise to it.

As to the nature of the effusion, if the signs leave us in doubt the use of the aspirator usually decides with certainty. Hectic fever, sweats, œdema of the chest, bulging of the intercostal spaces, prom-

inence of the veins of the chest, and leucocytosis indicate the presence of pus. Sero-fibrinous effusion, however, may be attended by protracted fever, with general prostration. On the other hand, purulent effusion may exist without definite symptoms.

The "De Musset" sign in pleurisy, a rhythmical antero-posterior nodding of the head, synchronous with the radial pulse, thought to be pathognomonic of aortic disease, noted in a case of left pleurisy with large effusion. The degree of effusion seems to play an important rôle in the production of this physical sign. M. H. Frenkel (*Presse Méd.*, Nov. 14, 1900).

As to whether the effusion is tubercular or infectious, when one-half or more of the liquid consists of lymphocytes it is probably tubercular. A tubercular effusion also shows polynuclear leucocytes at first—sometimes with bacilli which cannot be cultivated. Lymphocytosis occurs gradually. Punctures should be made once a week and the exudate examined. Lymphocytes must be distinguished from degenerated polynuclear forms and pseudolymphocytes. Epithelial cells, while rarely seen, may have degenerated so that they resemble Ehrlich's large mononuclear cells. Widál, however, considers these mononuclear leucocytes, since they have frequently been found in pleural effusions. In acute, infectious pleurisy polynuclear and epithelial cells are in the majority. A. Wolff (*Berliner klin. Wochen.*, Feb. 10, 1902).

Etiology.—Pleurisy occurs at all ages, even in the infant of a week or two, as well as in the aged. Sero-fibrinous pleurisy is probably most common between the ages of twenty and forty, while empyema is more frequently met with in children under ten years of age. Males, especially in the middle period of life, suffer much oftener than females.

Chill from exposure to cold and wet is often the exciting cause of pleurisy. It probably acts here, as well as in other dis-

eases, by lowering vitality through disturbance of nutrition, thus rendering the pleura more susceptible to the agent exciting the inflammation.

A weakly constitution and previous ill health have a marked effect in lowering the powers of resistance to the influences that produces disease. This is especially evident in the liability to pleurisy among those who have a tendency to pulmonary tuberculosis.

Pleurisy often results from extension of inflammation from neighboring diseased organs, especially from the lungs; also from the pericardium and mediastinum. It may follow also injury of the chest-wall and lungs. It may also occur in the course of acute or chronic diseases, such as septicæmia, the acute fevers, acute rheumatism, Bright's disease, hepatic cirrhosis, and malignant disease.

All the cases of primary pleuritis which occurred in the clinic at Zurich in ten years amounted to one hundred and sixty-three cases. It often commenced like an infectious disease. Engster (*Deut. Archiv f. klin. Med.*, B. 45, A. 3-6, '90).

Acute rheumatic polyarthrititis is very frequently associated with inflammations of the pericardium, endocardium, and pleura.

The infectious element of rheumatism after entering the circulation causes, primarily, certain general disturbances of the organism, then locates itself upon and in the serous membranes. Fiedler (*Schmidt's Jahrbücher*, No. 1, '92).

During the secondary stage of syphilis a specific form of pleurisy may develop, being frequently bilateral, arising and disappearing rapidly, the recovery being perfect and influenced by specific treatment. The affection generally makes its appearance two or three months after the appearance of the chancre, and rarely as late as from eighteen to twenty-four months afterward.

The onset may be insidious and unmarked by any symptoms; or acute,

and accompanied by pain, cough, and dyspnoea; the former being probably the more frequent. When the latter is the case, the pleurisy may possibly be diaphragmatic. Fever is, as a rule, moderate, and the rise of temperature so frequently seen at this stage of syphilis is probably often due to a pleurisy which is undetected because of the absence of suggestive symptoms.

Of the 14 cases studied, 3 were examples of dry pleurisy and 11 of serous effusion; half were unilateral and half bilateral. Duration is generally about two or three weeks if specific treatment is adopted, and prognosis is good, perfect recovery being the rule. Chantemesse (*La Presse Méd.*, June 30, '94).

Pleuritic effusions in connection with ovarian tumors are to be regarded not as an independent complication, but as a direct result of the presence of the neoplasm. The effusion develops gradually and is unaccompanied by pain or fever. The accumulation of fluid is not due to the presence of the tumor or to changes in the blood, but is really an evidence of metastasis to the pleura, less frequently of peritoneal irritation transmitted through the diaphragm. It is, accordingly, strong evidence of the malignant character of the tumor, provided that torsion, suppuration of the cyst, etc., can be excluded.

A pleuritic effusion, instead of furnishing a contra-indication to operative interference, may show the necessity of an early operation, provided that the peritoneum is not too extensively involved. Resinelli (*Annali di Ostet. e Ginecologia*, No. 18, '97).

Two cases of pleuritis occurring in the course of typhoid fever, in which the typhoid bacillus was secured in pure culture from the aspirated fluid. The fluid was serous in one case, and sero-sanguinolent, becoming purulent later, in the other. Achard (*La Sem. Méd.*, Oct. 19, '98).

But in the majority of cases pleurisy occurs quite independently of any of the foregoing conditions. Examination of the effusion has shown that in many cases the disease is due to irritation of

the pleural membrane by microbes, of which those most frequently met with are the tubercle bacillus, pneumococcus, and streptococcus.

Forty-four cases of pleurisy—37 serous, 7 purulent—investigated. In most sero-fibrinous effusions there were no micro-organisms. The presence of staphylococcus pyogenes in a serous effusion does not mean that it will necessarily become purulent. Absence of organisms in empyemata points most probably to a tubercular origin. Presence of diplococcus in metapneumonic serous effusions does not prove that they will become purulent. Exclusive presence of Fraenkel's pneumococcus usually justifies a good prognosis, notwithstanding the radical operation is the best. Levy (*Archiv f. exper. Path.*, etc., July, '90).

In the bacteriological study of cases of sero-fibrinous pleurisy there were found pneumococci in 4 (20 per cent.); staphylococci in 6 (30 per cent.); Eberth's bacillus in 1 (5 per cent.); tubercle bacilli in 3 (15 per cent.); and undetermined organisms in 6 (30 per cent.). The pneumococcic cases are frank, sthenic, and benign in tendency. Those due to staphylococci are more insidious in onset and less frank in their symptomatology. The cases due to Eberth's bacillus occur in the course of typhoid fever, are latent in their symptomatology, and are often somewhat hæmorrhagic. The tuberculous forms tend to be dry and fibrinous. Fernet (*La Trib. Méd.*, Feb. 27, '95).

Of cultures made with fluid withdrawn from 38 cases of sero-purulent pleurisy, 28 remained sterile, while 4 showed pure colonies of staphylococcus albus; 15 of the 28 were cases of pleurisy in which the affected region was the focus of a tuberculous infection; 1 was a case of pleurisy developing in a case of pulmonary tuberculosis; 7 had suspicious signs at the apex; and 4 were apparent cures. Lemoine (*Sem. Méd.*, Mar. 27, '95).

There can be no doubt that the tubercle bacillus is the most common cause of dry pleurisy and of pleurisy with serous effusion. This view is supported by

many considerations. Persons with an inherited tendency to tuberculosis; as well as those with tuberculous disease of the lungs, are specially liable to these forms of pleurisy. Many of those who recover from the effusion afterward suffer from the tuberculous disease, especially of the lungs. This termination is of too frequent occurrence to be merely a coincidence. Many French observers believe that 75 per cent. of all such cases are of tuberculous origin. This estimate is considerably higher than that of English and American observers, but the proportion of cases of tuberculous origin is increasing year by year as the investigation of cases becomes more thorough. Examination of the effusion by culture-methods often gives negative results; but inoculation of the serum into guinea-pigs, where large amounts—15 cubic centimetres or more—of the serum is injected, is much more successful, many of them becoming infected even when the fluid appeared sterile. Purulent effusion, if sterile, suggests tubercle bacillus as a cause; if not sterile, it is probably always due to pneumococcus, streptococcus, or some other microbe.

Of 101 cases of pleurisy examined post-mortem, 32 were definitely tuberculous and 13 existed in patients with tuberculous lesions of the lungs without any definite proof of the tuberculous character of the pleurisy. By far the commonest forms of pleurisy were sero-fibrinous or fibrinous exudation, secondary to acute disease of the lungs, or occurring at the termination of chronic affections of the heart, arteries, or kidneys. Osler (Trans. Mass. Med. Soc., '93).

Two hundred cases examined with reference to the questions: Is there an "idiopathic," non-tuberculous, serous pleurisy? Is there an acute rheumatic pleurisy, equivalent to a previous acute arthritis? Are there serous exudates, with pyogenic organisms, which do not become purulent?

Forty-three of the 200 cases were demonstrated to be tuberculous by finding bacilli in the sputum or other products. Nineteen more had the suspicion of tuberculosis in the history. Of the 200 cases only 7 gave a positive result when examined for bacteria. Out of 17 inoculations only two, belonging to the 7 just mentioned, gave positive results. These were: 1 case of sepsis and 1 of tuberculosis. The others were: metapneumonic, 2; so-called idiopathic, 2, 1 of each showing streptococci and 1 pneumococci; 1 following gangrene of the lung with streptococci. The first 2 patients died. In the other 5 the exudates became purulent ultimately. Operation is not always necessary in such cases. Some recover spontaneously.

In all the rest of the 193 cases bacteriological examination was negative. Of 13 cases belonging to the class of demonstrable or suspected tuberculosis, inoculations in guinea-pigs gave positive results in 7. Of inoculations in 12 suspected cases, 3 were negative. A similar proportion was observed in the so-called idiopathic cases, 9 out of 12 causing tuberculosis in guinea-pigs. This confirms the view that most cases of idiopathic pleurisy were tuberculous. Asch-off (Zeit. f. klin. Med., B. 29, p. 440).

Tubercle bacilli are transported to the parietal layer of the pleura inclosed in leucocytes. They may almost invariably be found in the acute sero-fibrinous form of tubercular pleurisy, either in the liquid or in the false membrane. Péron (Bull. de l'Acad. de Méd., Oct. 27, '96).

Leaving out cancer of the pleura, all sero-fibrinous pleurisies are grouped into three classes:—

1. Tuberculous, pleurisy of the type known as acute, primary, or *a frigore*.

2. Pleurisy from miliary tubercles of the pleura in the course of a general tuberculosis.

3. Pleurisies secondary to lesions of the lung; (a) by subpleural infarcts; (b) by subpleural hepatization; (c) pulmonary congestions. Le Damany (La Presse Méd., Nov. 2, '98).

Idiopathic pleurisy *a frigore* is really of a tuberculous nature: sometimes pri-

mary, sometimes secondary to pulmonary lesions. The most certain diagnostic method is the microscopical examination of the centrifugalized deposit from the effusion. In cardiac and renal cases there is nothing but scales of endothelium formed of a few cells and also a few red corpuscles: that is, the contents of an œdematous exudation. In pleurisies due to the pneumococcus, streptococcus, etc., the chief elements are multinuclear leucocytes; the red corpuscles are more numerous. Finally, in tuberculous cases there are lymphocytes and numerous red corpuscles. The lymphocytes not looked upon as having migrated from the vessels, but as the locally formed product of the tuberculous process. The frequent cure of acute idiopathic pleurisy does not disprove its tuberculous nature, for it is the most curable of the tuberculoses of the serous membranes. Dieulafoy (Brit. Med. Jour., from Gaz. degli Osped., July 4, 1901).

Of 1000 cases of phthisis at all ages, 88 were preceded and 68 accompanied by pleurisy. Of the 88 in which pleurisy was a forerunner there was a more or less clear family history of phthisis in 40. In 8 more than ten years elapsed between the pleurisy and the diagnosis of phthisis; in 10 the phthisis immediately followed the pleurisy; the average time between the two was 4.3 years. Thus 8.8 per cent. of all the cases of phthisis were preceded by pleurisy—a percentage sufficiently high to justify Penzoldt's dictum that pleurisy should always raise the suspicion of tuberculosis. In the classification of cases of pleurisy clinical data were alone available, since specific organisms were found in but a fraction of the total number. Of 210 cases of pleurisy the effusion was probably a transudation rather than exudation in 10. Of the remainder, 148 were accompanied by effusion,—52 were "dry." The right side was affected in 101, the left in 92, and both sides in 7. Males were affected more often than females (140 to 60). The cases were most numerous in the second and third decades of life; this corresponded to and was consequent on the age of incidence

of phthisis. More than half the 200 cases were "idiopathic,"—that is, had no discoverable cause. Of the remainder, 21 were certainly and 22 probably tuberculous (together equal 36.5 per cent.), 7 were post-rheumatic, 8 post-pneumonic, 2 post-influenzal, 12 traumatic, 5 complicated by morbus cordis, 5 secondary to neoplasms, and 12 complicated infective diseases. Grober (Sonder-Abdruck aus Centralb. f. inn. Med., No. 10, 1902).

Pleurisy due to the pneumococcus may be primary, but is often secondary, to pneumonia. The exudation into the pleura caused by the pneumococcus may be plastic or fibrinous, such as occurs usually in pneumonia; it is occasionally sero-fibrinous, but more frequently it is purulent. The pneumococcus is usually the cause of empyema in children in many of whom no preceding pneumonia can be demonstrated. The pleurisy is usually primary unless an interval of a day or more occurs after the defervescence of pneumonia before the symptoms and signs of pleural effusion set in; but there may be no interval, the empyema beginning before the pneumonia ends, or the interval may be protracted even to several weeks.

Parapneumonic pleurisy generally begins with the pneumonia, or at least follows its appearance very closely. In most cases the effusion is discovered on the second or third day of the illness, develops rapidly, and may disappear as quickly. It is exceptional to see a parapneumonic serous effusion become purulent. In the very rare cases where it does so, it is not due to pneumococci, but to the ordinary micro-organisms of suppuration: streptococci or staphylococci. Lemoine (La Sem. Méd., Jan. 13, '93).

Streptococcal pleurisy is the typical empyema of the adult. The infection may take place directly from the lung as from broncho-pneumonia, gangrene of the lung, pyæmic abscess, or tubercle; or

from more distant parts, as from ulceration of the œsophagus, abscess in the mediastinum, subphrenic abscess, caries of the spine, etc. The germ may come from the blood in general diseases, as septicæmia, fevers, erysipelas, etc.

Morbid Anatomy.—As in inflammation of serous membranes generally, there occurs hyperæmia, proliferation and desquamation of endothelial cells, exudation of serum, and leucocytes on the surface of the pleura. The pleura loses its polish, partly on account of these changes and partly on account of fibrin, which forms a thin layer on its surface. In more severe cases the fibrin forms in thick, shaggy masses, of which the layers in contact with the pleura are more or less densely laminated. The fibrinous exudate forms on both surfaces, but more densely on the visceral pleura usually because infection generally takes place from the lung.

If the inflammation ceases at this stage we speak of it as a dry pleurisy. The exudate is partly absorbed and partly organized, adhesion of the opposed pleural surfaces resulting. It is probable that in mild cases all the exudate is absorbed, leaving no adhesions or other traces of inflammation. This is difficult of demonstration, but we know that even severe peritonitis may leave no permanent adhesions, and from analogy we have reason to believe that similar results occur in pleurisy.

There are, at least, three distinct forms of pleurisy: (1) a form in which "fibrinoid degeneration" occurs along with marked filtration of the pleura by cells; (2) a form in which there is a general increase of the connective tissue of the pleura without marked filtration by cells and without "fibrinoid degeneration" of the connective-tissue fibrils; (3) a form in which the whole thickness of the inflamed pleura consists of highly-vascular and very young cicatricial tis-

ues. Endothelium may be found covering the "false membrane," and the connective tissue of the pleura itself may undergo the change termed "fibrinoid degeneration." W. S. Lazarus Barlow (Brit. Med. Jour., Sept. 3, '98).

In the early stages of tuberculous pleurisy the lesions are not different from those of simple inflammation, excepting for the presence of the bacillus; and, even later, distinct tubercles often do not form. A. N. Péron (Presse Méd., Feb. 19, '98).

As a result of the study of 439 cases of pleurisy treated in the Boston City Hospital between 1880 and 1895, the writer concludes that about 10 per cent. of these cases are known to have developed tuberculosis. Over 55 per cent. of all the cases which were followed to their death died from some form of tuberculosis. Tuberculosis, when it occurred, developed within five years in over 50 per cent. and within ten years in over 70 per cent. The danger of evil consequences is much increased by a tuberculous family history or a personal history of some form of tuberculosis previous to the attack. G. G. Sears (Boston Medical & Surgical Journal, Feb. 25, 1904).

SEROUS AND SERO-FIBRINOUS EXUDATION.—In many cases besides the fibrin there is a tangible quantity of serous exudation containing fibrinous shreds. The fluid varies in quantity from a few drachms to an amount sufficient to enormously distend the chest. Unless circumscribed by adhesions the fluid collects at the lower and back part of the pleural cavity, allowing the lung in this situation to collapse by relieving it of the suction-action of the chest, to the extent of the bulk of the fluid. The fluid is yellowish, with a faintly-green tint, alkaline, and usually highly albuminous. Besides containing large cells from the proliferating endothelium, and a varying number of red blood-corpuscles, the fluid also contains leucocytes in

various stages of transformation into pus. The pus-cells usually render the fluid somewhat cloudy and may be so abundant as to convert it into a sero-purulent exudation. The amount of fibrin varies: in some cases it forms only a thin layer on the pleura; in others, besides a thick creamy layer, it forms whitish, curdy masses in the lower part of the fluid.

If the effusion fills the pleural sac the lung will be compressed into a dark airless and even bloodless mass at its root and soon become carnified. In such cases the mediastinum and the heart and large vessels are displaced *en masse* to the opposite side. In left-sided effusions the cardiac impulse may appear near the right nipple and is caused by the impact, not of the apex, but probably of the right auricle and base of the right ventricle. There is probably no rotation of the heart even in the most extensive cases, nor any kinking of the inferior vena cava. (Osler.)

Series of 20 cases of primary pleurisy in which the leucocytes were counted daily from entrance to discharge or recovery. Their number exceeded 10,000, the normal limit, in only 13 of 224 counts. Nine of these occurred in one case with a secondary pneumococcal infection. Nine of the cases were certainly tubercular, the others probably so. In the cases certainly tubercular the count never exceeded 10,000. There was no evident relation between the duration of the disease or the temperature and the number of white cells. Blood and microscopical amounts of pus in the fluid did not affect their number. There was no apparent relation between the amount or progress of the fluid and the leucocyte-count.

Serous pleurisy is only exceptionally accompanied by an increase in the number of white corpuscles, and then intermittently. The white count is of value in two ways in the diagnosis of serous pleurisy. If the physical signs are doubt-

ful, and there is no leucocytosis, the condition is almost certainly not pneumonia or empyema, but serous pleurisy. If there is a serous pleurisy and a continuous leucocytosis, some complication is present. H. L. Morse (Boston Med. and Surg. Jour., Dec. 13, 1900).

PURULENT EFFUSION.—The character of the effusion is determined by the virulence of the microbe exciting the inflammation and by the resisting powers of the tissues. The effusion may begin as a sero-fibrinous exudate, and later, on account of increased activity in the inflammatory process, become richer in cells until it is altered to a purulent fluid. In most instances, however, the exudation is purulent from the first, especially in streptococcal infection.

The effusion may consist mostly of serous fluid with thick, yellow pus and fibrin-masses which settle to the bottom on standing, leaving the upper parts clear. In the severer cases the fluid consists of thin, yellow pus, and little, if any, fibrin is deposited on the pleural surfaces. The pus usually has a sweetish odor, but may be foetid, in most cases from some obvious cause, as a punctured wound, gangrene of the lung, etc.; it may, however, be putrid apart from such causes. In long-standing cases the pleura becomes a dense, grayish membrane one or two millimetres in thickness. The thickening is greatly increased by retraction of the chest-wall, and the density may become almost cartilaginous. When such pleural changes are general, the lung is compressed into a small carnified mass lying close to the spine.

ENCYSTED, OR LOCULATED, EFFUSION may be either serous or purulent, more frequently the latter. Such circumscribed effusions frequently result from perforation of an abscess into the pleura, adhesions preceding the perforation. Instances are not infrequently met with

where hepatic and subphrenic abscesses perforate the diaphragm. Loculated effusions are most common at the back, but may occur anywhere. Not infrequently they occur in the interlobar fissure, being probably usually due to tubercular deposit, which should be carefully sought for in this location. Purulent collections in this situation may attain large dimensions and look like abscesses of the lung. These loculated collections are very difficult of diagnosis, and justify the free use of the aspirating needle.

HÆMORRHAGIC EFFUSIONS are occasionally met with and are usually due to tuberculosis of the pleura, less often to carcinoma. They may occur also in Bright's disease, cirrhosis of the liver, and in malignant cases of the eruptive fevers. They are also occasionally met with in persons apparently free from any of these diseases, although even these may be tuberculous.

Prognosis.—The pleura not being a vital organ, disease of it can prove fatal only (1) from septic absorption, (2) from extension of disease to other structures, or (3) from the volume of the exudate interfering with the functions of neighboring organs.

The liability to sepsis depends on the nature of the infective organism. Streptococcal infection is the most grave, as even after free drainage is established it may give rise to general sepsis. Pneumococcal cases usually run a favorable course, a few cases recovering after aspiration alone. In tuberculous cases the exudation is often sterile; if the infection is confined to the pleura, they do well.

After-history of 300 cases of pleurisy with effusion, the diagnosis being confirmed in each case by tapping. It was possible to trace but 152 of the cases and upon these the report was

based. In none of these cases was there evidence of tuberculosis of other organs at the time of tapping. Of the 152 cases, 80 were found to be in good health at the end of from 5 to 21 years; 37 were well at the end of periods under 5 years; 23 had contracted tuberculosis; 14 had died of other causes. The conclusions based on the report were that 80 per cent. of uncomplicated cases of pleurisy with effusion are well at the end of 5 years and that more than half of them are well at the end of 10 years or more. Only 15 per cent. developed demonstrable tuberculosis and in many of these only after long periods of time after the pleurisy, as high as 16 and 14 years in some instances, only 3 per cent. showing that disease after 2 years. The type of tuberculosis was a mild one. A study of the clinical records showed that only one-fourth of the cases well at the end of 5 years or over had any family or past history of tuberculosis. The family history is considered to be of great value in determining prognosis; in fact, of more value than the physical signs at the time of the pleurisy. The fact that no attempt was made to discover what percentage of the cases of effusion was due to tuberculosis means that the prognosis is good whatever be the cause. In discussing this paper Osler said that most members of the profession had held the idea that serous effusion was a very serious condition. This paper put it in a much more favorable light. Harris said that the statistics in England were much more unfavorable than these, the effect of pleurisy being regarded very seriously. There it is the rule of insurance companies not to accept cases of pleurisy until after a lapse of 5 years, tuberculosis being feared. Jacobi said that the fact that most people of advanced age showed signs of previous pleurisy proved that prognosis was not so unfavorable in that disease. R. C. Cabot (Amer. Medicine, May 17, 1902).

In sero-fibrinous pleurisy the danger is from the bulk of the fluid, the occurrence of double effusion, and from the occurrence of pericarditis. Even large effusions may absorb rapidly, but are

more likely to do so after aspiration of part of the fluid.

In children and young adults, acute primary sero-fibrinous is rarely fatal, absorption taking place within a few weeks. Tuberculous cases are, of course, less favorable, as the bacilli usually invade other structures, especially the thoracic glands.

In advanced age serous effusions are much less frequent and the prognosis is less favorable.

Treatment.—In all cases rest in bed is necessary, and should be continued until the acute symptoms abate. In mild cases this care is necessary on account of the frequency of the tuberculous origin of this disease.

In mild cases of dry pleurisy little treatment is needed. If pain is troublesome, hot applications or mild counter-irritants may be sufficient to give relief; if more severe or if cough is troublesome, small blisters over the seat of pain may suffice. Much relief in these as well as in more severe cases may be obtained by immobilizing the side by applying overlapping strips of adhesive plaster extending from the spine to the sternum, the first strip being applied at the end of a forced expiration.

In cases of more severe pain six to ten leeches may be applied if the patient is in ordinary robust health; but they should not be used in the young or the aged. The bleeding may be encouraged by hot fomentations or a large poultice. After the bleeding has ceased, a firm bandage applied to restrain the movements of the chest may give relief, or even the adhesive plasters may be used.

Ice-bags applied over the affected area and kept in place by a bandage often give equally good relief, but heat is more agreeable to many.

In the more severe cases hypodermic

injections of morphine are the most effective means of obtaining relief.

If cough is troublesome, it may be relieved by small doses of morphine or codeine. For the fever, if high, sponging with water as cool as can be borne usually suffices.

When there is moderate sero-fibrinous effusion, in addition to these means, purging with concentrated saline solution may be tried in ordinarily robust patients. For this purpose half an ounce or more of saturated solution of magnesium sulphate is given in the morning before food is taken, the object being to excite copious liquid evacuations from the bowel in order to deplete the blood and thus lead to rapid absorption of serum from the lymph-spaces generally and among them, the pleural cavity especially. During the administration of the saline, the food should be dry and the quantity of liquid taken very small.

At a later period potassium iodide is recommended, but is of doubtful efficacy. Painting the affected side with iodine or the application of a succession of small blisters is advised and sometimes does good.

Should absorption not begin at the end of ten days or two weeks, aspiration of the fluid is the most rational and effective method of dealing with it. In the case of purulent exudation removal of the pus should, of course, be resorted to by aspiration, or incision and free drainage at once it is known to be present. Neither should there be any delay in aspirating very large serous effusions with evidences of intrathoracic pressure or with dyspnoea, lest symptoms of heart-failure suddenly set in.

Serous pleurisy which has not been tapped is recovered from better and more completely than one which is tapped. Even at the end of two months or more after paracentesis, some dullness, dimin-

ished vocal resonance, and feeble respiration persist. The cases of serous pleurisy are tubercular and it is thought that paracentesis withdraws from the organism a fluid which is its principal defense against the invasion of the bacillus. It favors the absorption of the residue of this liquid, and together with this the germs which it contains. In this way it hastens tuberculization of the lungs. Talamon (*La Méd. Mod.*, Mar. 9, '98).

Attention called to the neglected Levaschoff method of treating pleurisy by irrigation with normal salt solution. Despite the fact that the method was proposed eleven years before at the International Congress and an account of it was published in German, it received but little attention outside of Russia. The objections to it are mainly theoretical, and those who tried it consider it a valuable adjunct in the treatment of pleurisy with effusion. The author employed saline irrigations in a considerable number of cases of serous pleurisy with very good results. The normal salt solution was injected by means of a Potain syringe into the pleural cavity, the solution taking the place of the effusion which was withdrawn at the same time. The solution as well as the apparatus was rendered sterile by repeated boiling, and the entire operation was performed under strict asepsis. The fluid at the time of irrigation was heated to 35° C. (95° F.). Only a portion of the effusion was withdrawn,—as a rule, not more than 1000 cubic centimetres,—and of the injected saline solution only a portion remained in the pleural cavity, the object being to dilute the remaining effusion rather than fully replace it. With two exceptions, the operation caused no inconvenience to the patient. The irrigations with normal salt solution were followed by prompt amelioration of the distressing symptoms and final recovery. Tanfilieff (*Vratch*, Dec. 15, 1901).

During the pyrexial period aspiration is said to be very liable to be followed by a reaccumulation of the exudate.

It is often observed that the withdrawal of a comparatively small quan-

tity of even a very large effusion is followed by rapid absorption of the remainder. This is probably due to the removal of excessive pressure from the pleural lymph-vessels, allowing of their dilatation and of a free flow of lymph.

In nineteen cases of pleural effusion the removal by aspiration of a single cubic centimetre influenced favorably the absorption of the fluid and caused increased excretion of urine. Effect of this treatment is due to traumatic irritation. Jordan (*Pester med.-chir. Presse*, No. 25, '94).

In small effusions the puncture with the aspirator-needle must, of course, be made over the seat of effusion. When the effusion is large, so that the pleural cavity is nearly full, the best place for puncture is outside the angle of the scapula or in the middle line of the axilla, on a line with or a little below the nipple; that is, about the seventh intercostal space; as here the intercostal spaces are wide and the chest-wall thin. These places are safe unless the lung is adherent. The suction of the aspirator should be sufficient only to maintain a gentle flow of fluid. The flow is to be stopped as soon as the suction causes frequent cough, pain in the chest, or blood to appear in the flow.

The pain of puncture may be relieved by previously freezing the skin or by infiltration anæsthesia. It is best to incise the skin with a bistoury and then to introduce the needle with a sudden thrust, so that it may penetrate the layer of fibrin on the costal pleura and not carry it away from the chest-wall. Frequently the needle becomes obstructed by a fragment of lymph in passing through the fibrinous layer or by particles floating in the serum. Occasionally a case is met with in which the fluid will not flow on account of the lung being so bound down that it cannot expand. In such

we must be content with the few ounces that can be withdrawn.

Pleurisy is always to be treated as a serious disease; particularly if it is suspected to be of tuberculous origin special efforts are to be made to secure complete absorption of the exudation and full re-expansion of the lung. Nutrition should be maintained at the highest point possible by favorable sanitary conditions, by an abundant supply of suitable food, and by such medication as the special features of the case call for. Gradually increasing doses of creasote have appeared to be beneficial in some cases. Out-of-door life is as necessary in this as in other forms of tuberculosis. If retraction of the chest is progressive after disappearance of the fluid, residence in high altitudes may be desirable to stimulate expansion of the chest by breathing rarefied air.

Much may be done by the systematic practice of deep inspiration followed by slow, obstructed expiration. For children this may be effected by blowing bubbles or by having two large bottles, one empty and the other filled with water, connected by tubing and a suitable tube with mouth-piece inserted into the full bottle and the child encouraged to force the water over into the empty bottle by blowing into the full one. This may be done several times a day.

Every chronic inflammatory process in either lung or pleura that is not already infected with tubercle bacilli is in constant danger of becoming so. Hence, all such subacute processes should be carefully watched and treated until every trace of disease has disappeared. Fluid in the pleural sac compresses the lung so that respiration must be carried on upon the sound side; the muscles on the diseased side atrophy from disuse. If these atrophic muscles are not strengthened by proper gymnastics a feeble respiratory action is present, especially at the base, and hence becomes a fertile

field for the growth and multiplication of tubercle bacilli. All fluid accumulations should be gotten rid of as soon as it is evident that Nature will not absorb them. The reappearance of fever, after it has disappeared from the acute stage, is strongly suspicious of the presence of pus, which should be promptly evacuated and the cavity thoroughly drained. James (Penna. Med. Jour., Nov., '97).

EMPHYEMA, OR PURULENT PLEURISY, is to be treated by free incision and drainage. A few cases in children get well after one or two aspirations, but if pus reaccumulates free drainage should at once be effected. If the exudation is very large it is wise to remove much of the pus by aspiration and effect free drainage a day or two later. Even in the most desperate cases free drainage should be resorted to.

In order that drainage may be free it is usually best to resect a portion of a rib. If the exudation is being thoroughly evacuated through the drain, the discharge diminishes in a few days. The temperature should fall after the discharge of pus. Should it not do so either the drainage is ineffective or some other disease is present. It is rarely, if ever, desirable to wash the pleural cavity with any kind of fluid. Complete drainage suffices even in foetid cases; if foetor remains, the drainage is ineffective and washing out does not help it. Further, injections of even plain water or normal saline solution are dangerous. There may be sudden syncope, or there may be an ulcer on the pleural surface of the lung through which the fluid escapes into the bronchi and causes great shock or suffocation by obstructing the smaller bronchi.

It is superfluous to wash out the pleural cavity. Personally it was found necessary once in 399 operations upon 250 patients. It is a serious and dangerous procedure. H. B. Bowditch (Amer. Lancet, Dec., '89).

Personal method of substituting salt solution for the effusion of pleurisy tried in 52 cases, all followed by marked relief and prompt recovery. Thoracentesis is first performed, and as the effusion is gradually aspirated it is replaced by physiological salt solution, which prevents the collapse of the organs into the empty pleura, while the solution is gradually absorbed and exerts a general tonic and local antiseptic effect. Lewaschew (*Therap. med. Woch.*, June 28, '96).

The so-called incurable cases of purulent pleurisy can usually be cured by the siphon, as recommended by Revilliod, of Geneva. The suction of the valve causes expansion of the lung, while the continuous aspiration renders washing out of the cavity less necessary. C. G. Cumston (*Boston Med. and Surg. Jour.*, Nov. 22, '96).

Value of treating cases of empyema, after operation, by submerging the body of the patient in a bath of warm water emphasized. The force of the inflow of water with each inspiration is much greater than that obtained by means of any ordinary irrigator, and expiration drives out many tough, stringy masses which had not been affected by irrigation previously employed. The bath should be given at a temperature of 100° F., and the water should be rendered aseptic by previous boiling. In some cases an antiseptic may be added. The quantity of water should be sufficient to reach a few inches above the wound, and the child should be kept in it from ten to twenty minutes, until the water, with each expiration, returns clear. Adams (*Archives of Ped.*, Aug., '97).

Of 56 consecutive cases of empyema operated upon by primary exsection of a rib, 18 died: a mortality of 33 per cent. Sixteen of the deaths, however, were from causes which apparently had no connection with the surgical procedure. Scharlau (*Archives of Ped.*, Aug., '97).

Propriety suggested of treating purulent effusions occurring in pneumothorax in the same way as empyemata, even where the pus is not foetid, as tending to the prolongation of life and the

greater comfort of the patient. In foetid effusions there is no choice; such should certainly be evacuated and drained. As for the serous effusions, there are good grounds for thinking that the perforation in the pleura has become sealed up; the removal of a portion of the fluid need not be looked upon as inadmissible. Finlay (*Brit. Med. Jour.*, Jan. 8, '98).

The presence of air does not affect the principles of treatment in case of fluid in the pleural cavity. West (*Med. News*, Jan. 8, '98).

In many cases of operations for pyothorax some rise of temperature takes place after the operation. Among the many causes to which the rise may be attributed are intoxication by absorption from iodoform or carbolic-acid dressings, constipation, secondary and extra-thoracic abscesses, infection from some specific contagion, an unresolved lobar pneumonia or broncho-pneumonia, general septic infection, and, sometimes, deep-seated multilocular accumulations of pus not reached by the primary operation. There is also a class which do well for several weeks, and then show an irregular rise of temperature, although no local or general complications can be detected. In these cases the drainage-tube should be removed and the patient taken out-of-doors in spite of the fever. The successful management of pyothorax is not alone a matter of incision and drainage, but often calls for accurate clinical investigation and observation. Caillé (*Archives of Ped.*, Aug., '98).

Believing that if some substance could be brought into the pleural cavity which would cause a general deposit of fibrin on the pleural surfaces, then aspirate, adhesion of the cavity would prevent a return of the effusion; several different drugs—as iodine, potassium permanganate and the aniline dyes, fuchsin and methylene-blue—were tried. The last—thought more desirable than the rest, being antiseptic, anodyne, and diuretic—was used in twenty-four cases. To insure success, several conditions must be satisfied. The drug used should be in permanent solution; its reaction and specific gravity should correspond very

closely to that of the fluid in the chest-cavity. The material injected must be antiseptic or easily rendered aseptic, and the volume of fluid in the sac must remain unchanged. These conditions are accurately met by using a part of the contents of the pleural cavity for making the solution. A portion of the effusion was therefore withdrawn, methylene-blue dissolved in it: about 1 part in 50. The operation was performed with a medium-sized aspirating needle, fitted with asbestos piston and washers. The quantity of methylene-blue employed amounted to 5 to 15 grains, the most of them receiving over 10 grains. The amount of fluid removed varied from 60 to 100 cubic centimetres. The drug appeared in the urine in from three to nine days, the rapidity depending upon the quickness of absorption by the diseased membrane. The desired adhesions are thought to have been obtained. C. H. Lewis (Med. News, June 1, 1901).

Diaphragmatic Pleurisy.

In rare cases acute inflammation of the diaphragmatic pleura is characterized by extreme pain and distress. As inflammation of the pleura in this region without marked symptoms is of frequent occurrence,—for example, in all cases of pneumonia of the base of the lung,—the extremely distressing symptoms occurring in rare cases must be due to other causes than the inflammation of the pleura. The most probable cause is the extension of the inflammation to the substance of the diaphragm, rendering it sensitive to every movement.

Symptoms.—Pain is the most important symptom. It is referred to the line of insertion of the diaphragm or to the epigastric or hypochondriac regions, and over these areas there is usually much tenderness to pressure; also to pressure upward on the liver. The breathing is rapid, and, as far as possible, costal. The facies is anxious and the suffering evidently extreme. The temperature is high and pulse rapid. If the inflamma-

tion is confined to the diaphragmatic pleura there are no signs of exudation; in many cases, however, the inflammation extends upward later and presents definite signs of pleurisy. This is well illustrated in the case of a young man whom I saw with Dr. Cleland, of Toronto. There was extreme pain in the splenic region, but without any signs of pleurisy until the fifth day, when friction-rub was made out at the lower margin of the lung in the anterior axillary line. Later empyema developed, and the germ present proved to be the streptococcus. There was possibly also a perisplenitis. A good recovery was made.

A second case—a young man, also—seen with Dr. Shearp, of Milton, leaves no doubt of inflammation of the diaphragm. The left pleura was attacked, apparently also with consolidation of the lower lobe of the lung. Pain and distress were very severe. Three days later the lower lobe of right lung became affected and the pain was agonizing. Friction-rub was very marked. In two days signs of inflammation of the perihepatic tissue developed, with marked friction down nearly to the umbilicus. The temperature was high and general condition grave, the pain being almost unendurable. There was occasional cough, and the only expectoration obtainable gave a pure culture of the staphylococcus. Death took place on the twelfth day; an autopsy was not permitted.

The chief cause of extreme pain in this case was, without doubt, the inflammation of the diaphragm.

[Diaphragmatic pleurisy may be mistaken for pleurodynia or a tender point of neuralgia. Both sides are affected alike frequently. The determining cause is a microbic infection. The exudate may be purulent or subfibrinous. The pleurisy may be primary or secondary. A very constant and characteristic sign is the so-called diaphragmatic button:

a tender spot two fingers' length from the linea alba at the level of the tenth rib. It can be found even when there is no spontaneous pain. There is also tenderness along the attachment of the diaphragm, and another very tender spot on this line near the spinal column, as well as along the course of the phrenic nerve. Physical signs are: depression of the tenth rib, enlargement of that side of the chest at the same level, decrease of vocal fremitus, and absence of respiratory murmur. Other symptoms are those of ordinary pleurisy. J. T. WHITTAKER, Assoc. Ed., Annual, '94.]

Chronic Pleurisy.

There are two forms of this affection: one with and one without effusion.

1. Chronic Pleurisy with Effusion.—

This may follow acute sero-fibrinous pleurisy. Paracentesis may be performed from time to time, but the fluid reaccumulates. The exudate continues to be serous, with, in some cases, a large deposit of gelatinous material on the pleural surfaces. After some months or even years some retraction of the chest may take place, showing that the fluid has been partly absorbed. There may have been no symptoms beyond some dyspnoea on exertion, but lighter occupations may be pursued with comfort.

In other cases the affection is *latent* from the beginning. The onset is not marked by any symptoms that attract attention. With the accumulation of fluid, dyspnoea appears on severe exertion and becomes more easily provoked as the fluid increases. Inquiry into the history usually discovers more symptoms than the patient was aware of. He was content to attribute his failing strength to temporary causes without making an analysis of his symptoms. Clubbing of the fingers and toes may be marked.

Probably the great majority of these cases are of tubercular origin, analogous to cases of peritonitis with similar pathological changes and a similar history.

Aspiration should be resorted to in these cases and repeated as often as the fluid reaccumulates, as much of the fluid being removed as will flow without distress to the patient. Later, when it seems useless to repeat the aspiration, active counter-irritation to the chest may be continued and short courses of alteratives given. Every means possible to improve the general health should be adopted, as an out-of-door life, pulmonary gymnastics, nutritious diet, and change of residence. A sojourn in high altitudes does good in some cases, being followed by re-expansion of the lung.

If the exudation becomes purulent, it should be drained, ribs being resected if necessary, unless free incision is contraindicated by the existence of pneumothorax.

2. Chronic Dry Pleurisy.—This condition may be preceded by pleural effusion or develop gradually as a dry pleurisy. (a) In the first class after the absorption of the fluid there remains on the pleural surfaces more or less fibrinous deposit, some of which is gradually absorbed and the remainder becomes organized into connective tissue. This restricts the respiratory movement to some degree, causes some dullness on percussion, and feebleness or absence of respiratory sounds and, it may be, some retraction of the chest-wall. These results are more marked in the purulent cases, especially in those in which there has been long persistence of discharge. The pleura in these cases is a thick mass of connective tissue surrounding an airless carnified lung. In less marked cases there may be bronchiectasis.

(b) **PRIMITIVE DRY PLEURISY.**—Pleural adhesions very often occur without any history indicating pleurisy. It is rare not to find some adhesions at a post-mortem examination. They may

be local or general and be due to so slight a degree of exudation as to yield no signs on examination except Litten's diaphragm phenomenon. There may be no interference with respiratory function. Such adhesions may be due to acute or subacute pleurisy. In more considerable thickening there will be inspiratory retraction of the interspaces, loss of resonance on percussion, and feebleness or absence of the respiratory sounds.

The late Sir Andrew Clark was of the opinion that chronic dry pleurisy may lead not only to great thickening of the pleura, but to extension of the inflammatory process to the lung, causing marked fibroid changes in it: pleurogenic cirrhosis. Great thickening of the pleura and fibrosis of the lung often co-exist; but that the latter results from the former is open to question.

Similar changes occur in cases of chronic pulmonary tuberculosis, and for the production of the pleural thickening Fowler offers the following explanation: "Whenever a retracting lesion is present in the lung and is situated sufficiently near the surface, one or other of two events always happens: either the pleura becomes thickened or emphysematous bullæ are formed on the surface of the lung. If there is no lung-tissue between the retracting lesion and the pleura capable of undergoing distension, the former change occurs; if there is, the latter lesion is produced."

This applies to the non-tubercular cirrhosis of the lung, as well as to the extreme thickening of the pleura in chronic pulmonary tuberculosis.

ALEXANDER MCPHEDRAN,
Toronto.

PLUMBISM. See LEAD.

PNEUMONIA, CATARRHAL, OR BRONCHO-PNEUMONIA.

Synonyms.—Lobular pneumonia, vesicular pneumonia, disseminated pneumonia, broncho-alveolitis, broncho-alveolar catarrh, peribronchitis (Balzer), capillary bronchitis, suffocative catarrh.

Definition.—An inflammation of the terminal bronchus and the air-vesicles which make up a pulmonary lobule.

Varieties.—There are recognized two principal types of the disease: the *lobular*, in which the dissemination of the morbid process and the distinctly lobular involvement of the alveoli can be readily demonstrated, and the *pseudolobar*, in which the massing and extent of the affected areas gives a resemblance to the consolidation of croupous or lobar pneumonia. To this may be added that type at one time clinically distinguished as *capillary bronchitis*.

Symptoms.—As the severity of the pathological processes varies greatly in different cases, the symptoms have corresponding variability. In some cases the general symptoms are so slight that the patient walks around attending to his usual affairs, or, if a child, plays about, with but slight complaint except of cough, or as is likely to be said of "cold." This is not infrequent at the beginning of an attack of influenza, which may afterward prove quite severe, if unattended to; and it is the rule in the early stages of tuberculosis. The mistake of looking upon the case as one of simple bronchitis may thus easily be made.

Elevation of temperature, often surprisingly great, will, however, be discovered upon thermometrical examination; percussion and auscultation of the chest will reveal some of the characteristic physical signs. There may be slight pain in the chest, especially if there be pleural involvement, and this is more common

in influenza and tuberculosis than in other varieties of the affection. In other cases the symptoms, though rarely, except in influenza, sudden in onset, become quite severe from the first; there is prostration, with high fever, rapid pulse, headache, restlessness, pain in the chest, and respiratory distress, with quickened breathing, cough, and usually expectoration, though in children in whom the morbid process ensues as a sequel of some infectious fever the cough is at first dry and harsh. In infants and young children, moreover, there is often difficulty or even impossibility of expectoration; so that the moist sounds of air passing through the mucus retained in the windpipe and bronchi may be audible even to the casual observer; and there is then considerable distress in respiration, often approaching suffocation, thus giving rise to the common synonym of capillary bronchitis: suffocative catarrh. The matter expectorated is not, as a rule, blood-stained, but varies much in its physical characteristics. It is usually mucoid; sometimes, and especially in tuberculosis, muco-purulent; and in influenza often resembles boiled sago sprinkled with coal-dust. I have come to look upon this black discoloration of the influenzal sputum as quite characteristic. The appetite is impaired, the tongue coated, the lips red and dry at first, afterward cyanotic. The skin is dry and hot.

Physical examination at first, especially in children, may fail to reveal dullness or even blowing breathing, but there will be discovered, scattered over both lungs and often more frequent and more extensive at the bases, showers of fine subcrepitant râles. Sibilant rhonchi may likewise be heard. In the course of a day or two, sometimes later, scattered areas of dullness associated with bron-

chial or vesiculo-bronchial breathing, and moist râles, and sometimes with absence of breath-sounds, indicating atelectasis, are discovered. Of these some are constant and others appear and disappear: shifting dullness. They may be numerous and small or few and extensive; sometimes they are massive, involving the greater portion of a lobe or of a lung. These massive areas are constant, and over them the breathing is distinctly bronchial, closely resembling that of lobar pneumonia. Bronchophony may be present. In tuberculosis, what I have termed "the isolated apex sibilant râle" is quite characteristic. An apex pleuritic friction is sometimes heard; and usually as the case progresses there develop characteristic crackling, and the liquid râles indicative of softening.

As these signs develop, indicating extension of the local morbid processes, the symptoms become correspondingly severe. Dyspnoea increases and the respiration-rate rises, with children reaching sixty or seventy, with adults rarely exceeding fifty, and usually remaining below that number. Cyanosis now becomes manifest. There may be suprasternal and infrasternal retraction. At first, in severe cases, the children exhibit great restlessness and anxiety, obtunding of sensation takes place, drowsiness increases, and, while the breath becomes more gasping, the efforts to obtain air diminish. The heart becomes weaker, the right ventricle is evidently distended; the pulse is small, feeble, and fluttering; and death may occur from cardiac paralysis or from exhaustion. Sometimes there is delirium, cephalalgia, retraction of the head, and tenderness of the scalp and neck, apparently indicating meningeal complications, and convulsions may occur; at other times there is constant or intermittent delirium, with jactitation,

and this seems to be rather toxæmic than due to cerebral inflammation.

Two forms of laryngeal spasms observed complicating cases of broncho-pneumonia: one in which the mediastinal lymph-nodes were large enough to compress the recurrent laryngeal nerve; the other in which the lymph-nodes were not enlarged. The spasm can only be explained as reflex, due to the lesion in the lung-parenchyma. Variot (*Jour. de Clin. et de Thér. Infant.*, vol. iv, No. 32, '96).

Catarrhal pneumonia may be divided into three groups: 1. A primary one in older children not suffering from any exanthematous disease. 2. That following infectious diseases accompanied by inflammation of mucous membranes. 3. That met with in cachectic children, due to bad air, poor food, and in rachitis of the thorax.

In the first group we encounter high fever, in the second a long-continued fever, and in the third no fever. We occasionally elicit dullness over both lower lobes of the lungs in pneumonia, accompanied by bronchial breathing in the upper lobe, and this happens in catarrhal pneumonia, which might, therefore, easily be taken for tuberculosis. In severe disease of the lower lobes the upper do not expand well, so that quiescent air-columns are formed. Aufrecht (*Der Kinderarzt*, viii, p. 220, '97).

Four clinical types of infantile pneumonia recognized: (a) complete consolidation of lobar distribution, without signs of bronchial catarrh; (b) with no sign of consolidation, bronchial catarrh being generally distributed over one or, frequently, both lungs; (c) with bronchial catarrh and some areas of incomplete consolidation of lobular distribution; (d) with bronchial catarrh and larger areas of incomplete consolidation of lobar distribution. The differentiation of the last three types depends to a greater or less extent upon the degree of accompanying consolidation. The acute pneumonia of infancy and early childhood is a bronchial pneumonia in the majority of cases. James Carmichael (*Brit. Med. Jour.*, Oct. 15, '98).

Recovery may take place even in apparently desperate cases, and the symptomatic changes may be as sudden as in lobar pneumonia, though usually the process is gradual, but rapid. The duration varies from about ten days to about three weeks. In cases delayed beyond this the suspicion of tuberculosis or localized empyema becomes strong. Some cases, however, which are not clearly tuberculous, run a remittent or subacute course, and others gradually take on a chronic type.

Diagnosis. — There used to be much written concerning the differential diagnosis of capillary bronchitis and broncho-pneumonia. Post-mortem investigation has shown that the differentiation is impossible, for the two conditions usually co-exist. The difference is symptomatic only, and affects treatment only as this is guided by symptoms. The chief difficulties in diagnosis are to determine whether or not lobar pneumonia exists in a case presenting massive areas of dullness and to determine whether or not a case of recognized broncho-pneumonia is tuberculous. The recognition of influenza as the general condition is also important.

LOBAR PNEUMONIA. — As to lobar pneumonia, it is to be remembered that this is less frequent, though not altogether rare in the aged and in children under five years of age. Between five and sixty there is little diagnostic dependence to be placed on age. The mode of onset is different, lobar pneumonia developing abruptly with chill and lobular pneumonia coming insidiously and usually as a secondary infection. Lobar pneumonia is usually one-sided and limited; broncho-pneumonia is usually scattered over both lungs. Even when lobular foci are massed, it is more common to find the other side involved than in lobar pneu-

monia. Some shifting dullness is usually found in broncho-pneumonia. The râles of lobular pneumonia are rather subcrepitant than crepitant and the ringing râle is much more frequent than in lobar pneumonia. Rusty sputum is the rule in lobar pneumonia, the exception in lobular pneumonia. Lobar pneumonia terminates by crisis from the fifth to ninth day; broncho-pneumonia is more prolonged and subsides by lysis.

TUBERCULOUS BRONCHO-PNEUMONIA.—This form is much more common in adults and children than is commonly supposed. At Jefferson Medical College Hospital, where I saw many children and adolescents, I made inquiries as to the antecedents of many of the cases, and found that there could be separated a group of cases of *recurrent broncho-pneumonia* which was almost invariably tuberculous, and probably had been such from the outset. I have also seen many cases of recurrent fever and cough in young people, without physical signs other than of seeming bronchitis which I am sure are tuberculous and explain the numerous cases of healed and "latent" tuberculosis reported from the dead-house. Indeed, so far from feeling that I am called upon to establish the correctness of the suspicion of tuberculosis in cases in which this arises I am beginning to feel that the burden of proof rests on the side of exclusion. When a case is far advanced, microscopical examination of the sputum showing lung-fibre or tubercle bacilli clinches the diagnosis. Unfortunately, these signs are not available early and the diagnosis is often exceedingly difficult and doubtful. The points on which more or less reliance may be placed are as follows: 1. The course of the fever, which is usually remittent in simple broncho-pneumonia and often hectic or irregular in tuberculosis, though I have seen it sus-

tainedly high and falling by crisis in cases undoubtedly tuberculous. Sometimes the temperature is of the inverse type. 2. The duration of the case, which is more prolonged in tuberculosis, passing into a chronic or subacute course, though death at times occurs early. These cases form the group of *rapid consumption* in young adults, though not rarely recovery or arrest takes place. 3. The antecedents; that is, the personal and family history of the patient. Heredity plays a marked influence; so too do causes affecting the health of the parents, even though they themselves do not become tuberculous. Broncho-pneumonia following typhoid fever in a young adult is almost invariably tuberculous; and frequently does tuberculosis supervene upon the catarrhal pneumonia of measles and of influenza. 4. The physical signs are likely to be more pronounced in tuberculosis. There is some apical impairment. Crepitant and subcrepitant râles in the middle of a lung are more common. Sibilant râles in isolation are characteristic. As the case proceeds, the signs of breaking-down become evident.

INFLUENZA is usually recognizable by the suddenness of the attack, by the great prostration, by the severe headache, by the cutaneous hyperæsthesia and muscular pain, and by the disproportion between the great respiratory distress and the comparative paucity of physical signs. In cases of gradual onset and of extensive pulmonary involvement the diagnosis is much more difficult and depends upon the general association of symptoms. One point in favor of influenza in a given case would be the fact that a comparatively high fever—104° or 105° F.—in an adult is borne with little discomfort, the patient perhaps being scarcely conscious of fever. The character of the

sputum, its sago-like appearance, is also significant.

At St. Mary's Free Hospital for Children, New York, cases in which the physical signs are those of bronchitis, but in which the children appear unusually sick and have a temperature ranging above 102.5° in the axilla or in the groin, are regarded as possible cases of broncho-pneumonia and are treated accordingly. George M. Swift (*Archives of Ped.*, Apr., '96).

Etiology.—Broncho-pneumonia is sometimes an independent affection arising from "cold" or from direct irritation by smoke and noxious vapors and gases, and, in cases of such origin, it may likewise be associated with or arise by extension from inflammatory processes in the upper air-passages. It may be caused by chloroform and less often by ether administered for surgical anæsthesia in the presence of artificial light by combustion.

It may arise from purely local infection by agents recognized and not recognized, and probably not specific. It may occur in extension from bronchitis of any origin.

It is, however, usually met with as a complication or sequel of one of the infectious diseases, and especially of those of childhood. Even when it is the only or most prominent manifestation of the existence of infection,—as, for example, in influenza or tuberculosis,—it is to be regarded as secondary.

It may be associated with, or follow, measles, scarlet fever, small-pox, whooping-cough, influenza, tuberculosis, erysipelas, dysentery, meningitis, and typhoid fever.

It also occurs from the aspiration of food (schluck-pneumonia, deglutition pneumonia, inspiration pneumonia) or infectious materials in cases of anæsthesia or paralysis of the larynx, in coma of any origin, in malignant disease of the larynx and œsophagus, following hæ-

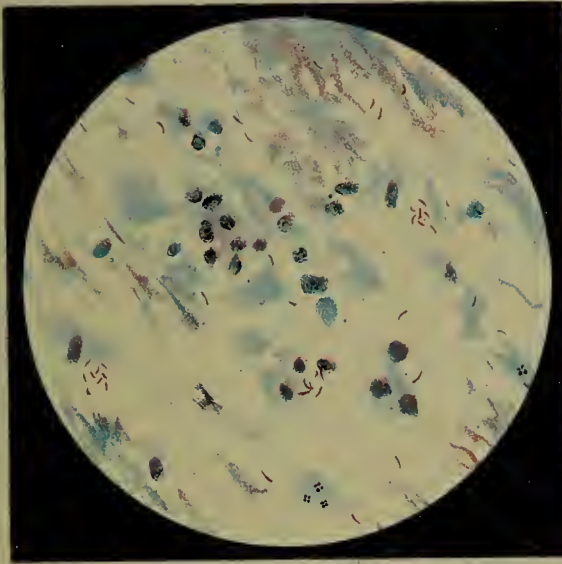
moptysis, following operations about the mouth and upper air-passages, and in some cases through the inspiration of matters from a vomica or from a bronchiectatic cavity, or, in exceptional instances, from the rupture into the lung of a purulent collection in the pleura, liver, or elsewhere.

Tuberculous broncho-pneumonia is the most common and most fatal form. Next in frequency is infectious broncho-pneumonia associated with the diseases of childhood, which, according to distinguished pædiatric authors, causes more deaths than do the fevers themselves. Rickets and diarrhœa are likewise mentioned by authors among the predisposing causes affecting children. Thus, while the disease occurs at all ages, it is much more frequent in childhood and infancy. Old age may likewise be considered a factor in creating susceptibility to the disease; and it occurs in association with the various diseases and degenerative conditions incident to the decline of life. At all ages the disease is most prevalent among the poor.

It is, therefore, essentially a morbid process occurring in persons of lowered or innately poor vital resistance; and in conditions which favor mechanically the entrance of infectious material into the bronchi.

Bacteriology.—Apart from the tubercle bacillus, the organisms most frequently found in broncho-pneumonia are the micrococcus lanceolatus, the streptococcus pyogenes, the staphylococcus aureus, the staphylococcus albus, the bacillus pneumoniae of Friedländer. In cases of diphtheria the Klebs-Loeffler bacillus is frequently found; and in influenza Pfeiffer's and other organisms have been reported. It is rare for pure cultures to be found except in the case of the pneumococcus, which is most frequently asso-

Fig. 2.



Tubercle bacilli (sputum).

Fig. 3.



Tubercle bacilli (urine).

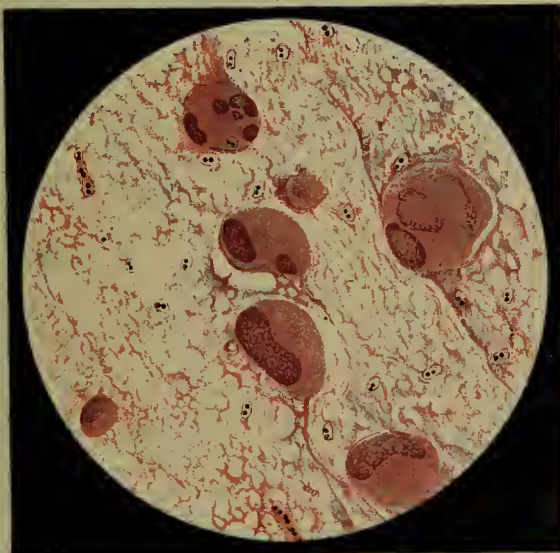
Fig. 1.



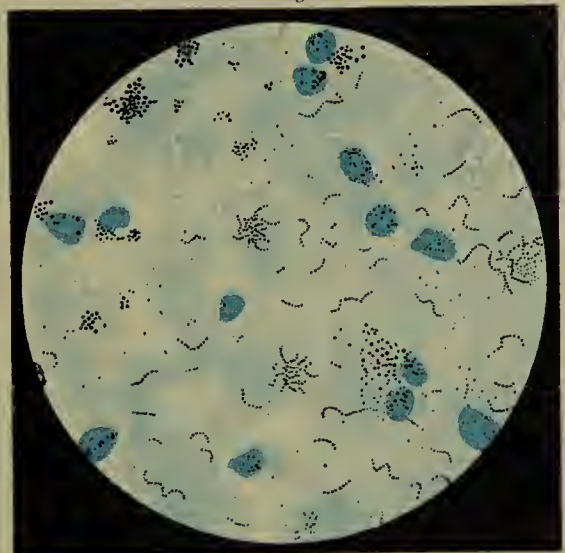
Capsulated bacilli of Catarrhal (Broncho-) Pneumonia. (Wright & Mallory)

Fig. 4.

Fig. 5.



Diplococcus Pneumoniæ.



Staphylococci and Streptococci.

ciated with the pseudolobar type of the disease, the streptococcus being most common in the lobular type. Mixed infection is the rule. Wright and Mallory have described a new capsular bacillus found by them in the lungs of a man who, three weeks after diphtheria, died with severe broncho-pneumonia (see *colored plate*).

The following conclusions are submitted: 1. That the primary and secondary broncho-pneumonias have a different bacteriological origin. 2. That secondary broncho-pneumonia is, for the most part, due to streptococcic infection derived from some source in connection with the air-tubes, throat, and mouth. 3. That primary broncho-pneumonia is of pneumococcic origin. 4. That pneumococcic inflammation occurs with almost equal frequency in the child and the adult. 5. That pneumococcic inflammation takes a different form in each,—in the adult producing massive consolidation, and in the child disseminated patches of consolidation. Samuel West (*Brit. Med. Jour.*, May 28, '98).

In the acute pneumonia of childhood bacteriology demonstrates that the pneumonia of infancy can in no sense be considered a specific disease, in the sense that it is due to any special organism, as similar, if not identical, pathological changes are produced in the lung-tissues by various organisms. The reason why the same infection that produces a catarrhal pneumonia in infants should produce a fibrinous pneumonia in adults or in children over five years of age is explained by the fact that the alveoli of the lung are not fully developed until about the fifth year of extra-uterine life.

Catarrhal pneumonia is essentially the pneumonia of infancy. Carmichael (*Edinburgh Med. Jour.*, Aug., '98).

Morbid Anatomy.—The appearances presented by the lungs in cases of broncho-pneumonia are complex, consisting in inflammatory changes in the bronchial tubes, and in pulmonary consolidation, both lobular and more extended. Some

of these pulmonary changes in both varieties are due to collapse and some to vesicular inflammation, lesions which are at times difficult to distinguish from one another, and they also give rise to considerable diversities in the aspect of the lungs.

The mucous membrane of the bronchial tubes is swelled, reddened, and thickened, at times materially diminishing the calibre of the tube. It is usually, but not always, covered with a thick, tenacious, or puriform mucus. In cases of some standing this mucus may become inspissated, so that the course of the bronchi is marked out by yellow lines. Fibrinous concretions are sometimes observed. The other coats of the bronchi are also thickened and swelled, so that their cut extremities stand out prominently from the pulmonary tissue to an extent which is more marked in the child than in the adult. The anterior branches are sometimes less affected than the posterior, particularly in diphtheria. The inflamed tubes tend to become dilated, owing to the loss of resistance of their wall, which is infiltrated with inflammatory products. In the larger tubes the dilations are commonly fusiform and cylindrical; in the smaller they are globular, and the terminal dilations may attain the size of a millet-seed or hemp-seed. They may stand out prominently on the pleural surface, and yield a yellow fluid when punctured, or they may, when distended by inspissated pus, strongly resemble tubercles. They may also rupture into the pleura and give rise to pneumothorax. In the more marked dilations the thickening of the walls disappears and they may be almost membranous. Dilation is more commonly marked in the broncho-pneumonia of whooping-cough.

The extension of the inflammatory

process to the lung is intimately associated with the process of collapse. The extent of collapse in infantile bronchitis is largely due to the obstruction of the bronchial secretion. It may occur both in lobular and disseminated and also in diffused form. In its early stages it is capable of insufflation, which distinguishes it in either form from lung-tissue filled with inflammatory products; but this capability for insufflation may be lost. It is generally distinguishable from pneumonic infiltration by being sunk below the level of the surrounding tissue, by its glistening smooth section, and by the fact that, when occurring at the surface of the lung, the pleura shows no sign of exudation and still maintains its transparency. Its areas are harder and resist pressure more than inflamed portions of the lung, and when scattered thickly throughout the organ may give to the finger the sensation of shot-grains. In these collapsed portions of lungs pneumonia tends to occur. Hyperæmia ensues, owing to the impeded circulation arising from defective respiratory movement; and this is followed by œdema. The collapsed portions become more bulky, of a deep-purple color, and softer than before. Under the name of "splenization" the condition has often been confounded with inflammation, as also has the condition which has preceded it, to which the name of "carnization" has been given. In neither of these states, however, has a true inflammatory exudation occurred. On pathological as well as clinical grounds it is important that the distinction should be maintained.

Inflammation is characterized by a greater solidity and increasing softness of the lung-tissue: characters which are unreliable except as questions of degree. The most important points of distinction are the loss of capability of insufflation,

the opacity of the tissue, and its duller-white color, which is frequently granular on scraping or section, or, if not granular, has a rougher appearance than the section of a simply collapsed part. If the inflammation has reached the surface, the implication of the pleura is a further distinction. The area of these spots varies, and sometimes the inflammatory change may be found scattered through a collapsed and congested part. They yield a milky juice on scraping or pressure, due to an epithelial proliferation in the interior of the alveoli, mingled with leucocytes which have probably escaped from the vessels. The amount of fibrinous exudation is, however, relatively small. Nodules of pneumonic change, probably proceeding by direct extension from the bronchi, may be found in the midst of collapsed portions without the intervention of congestion and œdema.

Lobular pneumonia thus frequently proceeds indirectly from lobular collapse. It arises also directly in the vesicular structure by extension from the bronchi. The nodules of vesicular pneumonia may vary in size from a pin's point to a hemp-seed, or they may be so small as only to be recognized by the microscope. At first the spots may have the dark-red color of the ordinary acute form, but they tend to pass rapidly into a dull-yellowish, opaque-white color, which has a finely-granular aspect. They are not markedly prominent, and they fade insensibly into the surrounding tissue, though when occurring in the midst of collapsed lung they stand out distinctly from the dull-purple ground on which they are situated. They are soft and easily broken down, and yield a milky juice on scraping or pressure. The nodules tend to become confluent, and may sometimes form racemose groups, but these are less distinct and less sharply defined than those

of tubercle. Their histological structure is identical with that of areas of lobular collapse, viz.: an epithelial proliferation mingled with leucocytes which fill the alveoli.

Balzer has described another process by which the lung is affected from the bronchi, viz.: by direct extension of the inflammation from the bronchial wall to the surrounding pulmonary tissue, which he regards as the most common form.

More diffused forms of pneumonic consolidation are found in some instances, and particularly in measles. It is probable that some of these arise from secondary inflammation of collapsed portions; others may arise from the confluence of lobules primarily affected, but it is possible also that a more diffuse inflammation may, in some cases, directly attack the lung without the intervention of either of these processes, and through the immediate effect of the poison of the primary disease.

The very varied proportions in which bronchial dilations and collapse and genuine pneumonic consolidation occur in different cases of capillary bronchitis—variations which are, in part, due to the diseases in which they severally originate—have led some authors to deny that a genuine pneumonia is present in these cases, and in some instances but little can be found post-mortem beyond the two first-named conditions. A genuine broncho-pneumonia does, however, occur.

The collapse which occurs in many exhausting diseases may lead to secondary pneumonia in the same manner as it does in the bronchitis of childhood. In many cases only congestion and splenization occur, but in others a true pneumonia presenting a striking resemblance to that of childhood is found.

Hæmorrhagic extravasations into the lung are not uncommon, and are mostly

subpleural and petechial, but may be more extensive.

Emphysema almost constantly accompanies broncho-pneumonia. It affects mainly the upper lobes, especially their anterior margins. This emphysema is sometimes termed "compensating," and is believed by some to originate in the lung expanding to occupy the areas between the collapsed portions. It is, however, more probably due, in part, to cough and, in part, to inspiratory effort, resembling that found in acute asphyxial conditions. Interlobular emphysema is not uncommon in fatal cases of whooping-cough at early ages.

The disease almost invariably affects both lungs. The amount and character of the affection may vary greatly on different sides: on one, collapse or diffuse pneumonia may predominate; on the other, pneumonia may be lobular and the amount of collapse small.

In the further progress of broncho-pneumonia there is little doubt but that in many cases a perfect *restitutio ad integrum* may occur, and that the lung may regain its normal condition. In other instances, however, dilated bronchi may long persist, with some condensation of the pulmonary tissue surrounding them, but may gradually return to the normal state, so far as may be judged of from the physical signs. Abscesses occasionally form, though usually they are small in size, and gangrene is sometimes observed in the affected portions. In rarer instances general consolidation of the lung may remain in a chronic form. In some instances the pneumonic nodules, particularly in scrofulous and rickety children, may pass into cheesy changes, with destruction of tissue, and may run the subsequent course of tubercle. In some instances the process is tuberculous from the beginning.

The associated pathology of bronchopneumonia presents but few special features apart from those of the diseases which it complicates. The pleura is almost invariably inflamed when the pneumonia reaches the surface, but effusion to any extent is not common. It is not, however, affected over collapsed portions, and, when these are superficial, the state of the pleura may aid in the diagnosis between collapse and pneumonia. The bronchial glands are swelled and medullary-looking. Sometimes they are distinctly hyperæmic, but, when the swelling is extreme, they may be pale. In a few cases they are unaffected. Sometimes cheesy spots or calcified nodules are found in them, but these usually accompany tubercles in the lung.

The dilatation of the right side of the heart, resulting from obstruction to the pulmonary circulation, may lead to persistence of the openings of the foramen ovale and ductus arteriosus. Thrombosis of the pulmonary artery is occasionally observed. Pericarditis is also an occasional complication.

The appearances observed in other organs are, for the most part, the result of venous congestion. Œdema and congestion of the brain are common in fatal cases. Meningitis of the base is a rare complication. The liver is congested, and hyperæmia and catarrh of the stomach and intestines are also common. In the large intestines the catarrhal congestion may even give rise to dysenteric changes. The kidneys are also congested, and concretions of urates are often found in the straight tubules of the pyramids. General dropsy is an occasional complication.

Treatment.—While to some extent dependent upon the exciting cause of the pathological process in the individual case, and subject to modification accord-

ing to age, sex, personal characteristics, environment, and so forth, the general lines of treatment in cases of bronchopneumonia are very much alike in all cases.

In the acute form of the disease rest is necessary, and, if the process be severe, rest in bed. Sufficient ventilation without exposure of the patient to draft is a necessity; and, in general, the temperature of the sick-room should be kept as near 70° F. as possible. When the patient is aged, or in the case of capillary bronchitis in children, a higher temperature, even to 80° F. is sometimes necessary. In capillary bronchitis, too, the air of the room should be kept moist by the evaporation of water, on which aromatic or terebinthinate substances (eucalyptol, menthol, etc.) may be thrown so that their vapors may be pleasantly and equally diffused.

After giving almost all the various methods of treatment a trial, the writer began to treat the patients by the "open-air" method. His results founded upon a study of 150 cases, not selected in any way, one-half of which were treated entirely indoors, and the others either partly or entirely out of doors, were eminently satisfactory. The death-rate was reduced from 66.9 per cent. to 31.5 per cent., and many symptoms in the course of the disease were alleviated or much improved. There was no favorable influence on the infection itself, the whoops being unaffected in number or severity; but the patients took their food ravenously, their general health was improved, and they slept much better. C. B. Ker (*Scottish Med. & Surg. Jour.*, p. 33, 1904).

Hot flaxseed poultices applied over the affected area, or, when the process is wide-spread, over the entire chest, front and back (jacket poultice), are of great service. The poultice should be well made by slowly stirring boiling water into successive portions of flaxseedmeal, and

the mixture should then be spread between two layers of cheese-cloth. Oiled silk should be applied over the poultice, and the whole kept in place neatly by pins or bandage. Well made, properly applied, the poultice should retain its heat from four to six hours. From two to three poultices are to be applied during the day, and "at bed-time" the skin is to be well dried and sponged with alcohol and alum, and the chest is enveloped in a jacket of lambs' wool. The following day and the third day, if necessary, the poultices are reapplied, the lambs' wool being again substituted at night. It is rarely advisable to continue poulticing longer than this. In some cases poulticing may be preceded by counter-irritation. The best method of counter-irritation is by means of a mild mustard plaster, made with the addition of glycerin and white of egg. This can be retained in position for an hour or two without bad effect. In children it is better to rub the chest with amber-oil night and morning. Sometimes the lambs' wool or cotton jacket may be applied immediately, or following upon the counter-irritation without the use of poultices. Considerable pain in the chest, wide-spread, or massive, consolidation or blocking of the air-vesicles constitute the indication for the use of poultices. In tuberculous cases, and when for any reason poulticing cannot be properly carried out, dry heat by means of hot-water bag, salt bag, etc., or moist heat by hot compresses may be substituted. The application of ice to the chest is strongly urged by some writers, and Mays has recently undertaken a collective investigation, cases of both croupous and catarrhal pneumonia being included in his reports, which are exceedingly favorable. I do not employ the ice-pack in broncho-pneumonia; but in

tuberculous cases when the temperature exceeds 100° an ice-bag over the heart should be applied.

In broncho-pneumonia applications of cold water to the affected side with cold applications to the head recommended, and, in the event of the temperature going above 103° F., cold plunges as best method of treatment. M. S. Marcy (*Archives of Pediatrics*, Feb., '99).

Study of means other than the internal use of drugs based on over 600 cases in infants and young children. Very few cases are primary, while the most serious of the causes of secondary pneumonia are diphtheria and measles. As the disease has no limit, runs no cycle, the preservation of vital resistance by not upsetting the stomach and disturbing the child is of great value. Little irritability, restlessness, or loss of sleep should be permitted. Good ventilation of the sick-room is essential; the temperature of the room should never pass 70° F. (21.1° C.); and a flannel undershirt alone is advised. He never used a cotton jacket. The child is kept in his crib, water is given between nursings, and the time of nursing is decreased, while the food is diluted. The bowels must be moved once a day. The child should not be needlessly disturbed, food and medicine being given at three-hour intervals. Steam inhalation with creosote (10 drops to 1 quart of water) under a croup tent, for thirty minutes every three hours, advised, admitting fresh air every ten minutes. With much catarrh he used turpentine ($\frac{1}{3}$) with oil ($\frac{2}{3}$), but mustard applications make the best counter-irritation. The boundaries to be covered should be marked out, and the plaster is to be made with 1 part of mustard to 2 parts of flour, applied for ten to fifteen minutes once in six to eight hours. Later applications should be weaker. They are especially effective at the onset, as are mustard-baths, especially in cases with marked prostration. Drugs internally are only indicated symptomatically, and great care is necessary not to disturb digestion. Expectorants are best given in powder or tablet form, dissolved in water, after

feeding. The ammonium salts are only given during resolution, in $\frac{1}{2}$ -grain (0.03 gramme) doses, and antipyretics are used only when the baths are badly borne. If there is much restlessness, Dover's powder may be given, watching its effect on the bowels. Heart-stimulants are, as a rule, used far too early, but are needed when the pulse becomes soft, rapid, and irregular—such as 150 during sleep. He considers tincture of strophanthus best, but strychnine is also good when pushed to full doses or till some result is noted. Digitalis upsets the stomach easily; whisky or brandy is rarely needed and is best employed late, when other stimulants fail. Nitroglycerin may be used, but frequently causes headache. A daily sponge-bath is advised, and when the fever reaches 104° F. (40° C.) a sponge or a cold pack is to be given. For the sponging, salt (3j—4 grammes—to a quart of water) or alcohol (1 to 4 parts of water) is used. This is done under a blanket, the water being gradually reduced to 80° F. (26.7° C.), continued from ten to fifteen minutes. Too frequent sponging tires the patient. Cold tub-baths have a very slight and temporary effect on this condition. He considers the cold pack the best hydrotherapeutic measure, given by using a large bath-towel, the entire body being covered to the knees. Warm water is first used, decreased gradually by sponging. The temperature is taken in a half-hour. Children may be turned from side to side and enjoy the cool pack. An ice-bag is applied to the head; hot-water bags to the feet. Oxygen, given for one-half minute every half-hour, is also of value. (C. G. Kerley.)

Dr. Wahrer, of Fort Madison, Iowa, mentioned the fact that many children are literally smothered to death by the treatment of pneumonia, and referred to several cases. Dr. Williams, of Chicago, laid special stress on the conservation of the child's vital resistance. Dr. Gilbert, of Louisville, uses ammonium bromide, but objects to any opiate, even Dover's powder. Dr. Tuley, of Louisville, said that the term capillary bronchitis should be discarded, as all such cases are pneumonia. Poultices, internal

antipyretics and nauseating remedies are all useless. Dr. Parks, of Birmingham, Ala., referred to several cases of asthma diagnosed broncho-pneumonia. He gives strychnine by rectal injection. Dr. Barbour, of Louisville, insisted that drugs are always needed in the treatment of pneumonia. He advised the cotton jacket. Dr. Kerley had found that Dover's powder was the least dangerous sedative. Chloral should never be given, because it upsets the stomach. He believes in drugs properly used, but only when properly used. (Phila. Med. Jour., May 16, 1903).

Sponging the entire body twice daily with tepid water and aromatics or alcohol adds greatly to the comfort of the patient. Should the temperature be high, cool sponging, the cold pack, or the bath may be used. There must not, however, be any sudden shock in the latter case. The child should be plunged in water at 95° F., gradually reduced to 80° during the first bath. Friction should be used and the duration of the bath be from eight to ten minutes. Subsequent baths with successively lower initial temperatures not falling below 80°, and final temperatures not falling below 70°, may be given at intervals of about four hours, whenever the temperature exceeds 104° F. The effect upon general comfort as well as upon temperature must be considered. In cases of meningitis or with severe cerebral symptoms, an ice-cap should be applied to the head.

In broncho-pneumonia water-baths or Priessnitz's wet cloths used to avoid asphyxia, cyanosis, and carbon-dioxide poisoning. To avoid venous stasis the position of the patient is changed every hour, and he is not allowed to remain long on his back. He is also made to take four or five deep inspirations every half-hour. Nothnagel (Med. Press and Circ., Jan. 9, '95).

As soon as a child has subcrepitant râles with slight fever, it should be systematically submitted to treatment by hot mustard baths as the best possible

means of forestalling an aggravation of the disease. Lemoine (Nord Méd., Dec. 15, '97).

The following measures are recommended for infants: At the very first onset of pneumonic symptoms—high temperature; diminished resonance; small, non-crepitant or crepitant râles; apathy; increased rate of heart-beat and respiration—the writer gives a bath of 86° F. (30° C.) for two minutes and then slowly reduces the temperature of the bath by adding cold water for from two to three minutes till a temperature of 76° F. (24.6° C.) is reached. The body of the patient is rubbed with a sponge or cloth or the hand to promote reaction of the skin and reduction of the body-heat. The bath-water need not, and in cases of feeble children should not, quite cover the body, but the water can be sponged on the chest, the patient lying in the arms of an attendant. If definite pneumonic symptoms be present the bath may have to be repeated at intervals of from eight to twenty-four hours. The cross-packs relieve the symptoms of bronchitis. The writer uses them extensively in incipient phthisis, but they give excellent results, and naturally prompt ones, in uncomplicated single bronchitis. They are applied in the following way. A linen bandage about one and one-half inches broad for infants and five inches for adults, and from two to three yards long, is placed in cold water (from 54° to 66° F.—12.2° to 19° C.), is well wrung out, and is applied to the chest thus: (1) beginning under the right axilla, passing over the left clavicle and round the chest back to the right axilla; (2) from here round the chest horizontally; (3) from the right axilla to the left and over the back and the left clavicle to the front (or left axilla). This bandage is covered in the same way with a thick single or thin double flannel bandage perhaps half an inch broader. This "pack" is applied at night and left till the morning; on removing it the chest must be well rubbed with a cold, wet towel, and then rubbed dry. T. Zangger (Lancet, June 28, 1902).

Outline of treatment: Castor-oil to clear the field of operation. Fresh air, cool and flowing. It reddens the blood, stimulates the heart, improves digestion, quiets restlessness, aids against toxæmia. Regulate the temperature of air of the room inversely to that of the child. The patient's feet must always be warm, and the head cool. Water, plenty, inside and outside. Temperature of the water as indicated by child's temperature. Quiet and rest. Tranquilizing influences about patient. Undisturbed sleep. Correct feedings to avoid fermentation and gas in abdomen. If there is need, high hot salines. Antipyretics. Water. No coal-tar products. Heart stimulants. Fresh air, hot foot-baths. Relieving tympanites and crowding. Hot foot-baths and hot salines can be given in a cold room. Both can be given under the bed-clothes. Whisky and strychnine. W. P. Northrup (Med. News, Apr. 30, 1904).

Ice may be applied over the heart, as already stated, whenever the temperature shows a tendency to exceed 100° F. The application should be continuous until the temperature declines, and should be repeated according to necessity. Should this fail to bring the temperature to or below 100° F., nitrogen monoxide, about 8 gallons daily, should be given by inhalation. As the rise in temperature is usually postmeridian, the inhalation should be given in the forenoon, four gallons being administered at about 9 o'clock and four at about 11 o'clock. This will also conduce to sleep at night.

Food should be given as in fevers generally, in small quantities, at intervals of two or three hours, and should consist of easily-assimilable and concentrated nutriment, pancreatized milk, beef-juice, egg-albumin, soft-boiled eggs, and the like. Children, the aged, and tuberculous patients are usually benefited by alcohol in small quantities, given with the food. The patient should be encouraged to drink sufficient water to keep up

to normal the quantity of urine excreted, and it is usually well to give a mild alkaline diuretic, as solution of potassium citrate or solution of ammonium acetate.

If there is any tendency to constipation, or any failure of daily action of the bowel, calomel, alkaline laxatives, glycerin suppositories, or enemata should be employed according to circumstances. It is usually well to begin treatment with the administration of calomel in divided doses.

General medication is useful. At the outset in the aged and in feeble children strychnine should be given in doses of about $\frac{1}{140}$ grain to $\frac{1}{250}$ grain, repeated at intervals of from one to six hours, according to age and effect. It is not well to make a profound impression with the drug, or the patient's recuperative force will be exhausted. A gentle and continuous support to the vital powers is the object aimed at. For emergencies strychnine may be given hypodermically in doses to suit the occasion. Should cardiac debility become alarming, strychnine should be supplemented by camphor, which in children usually acts efficiently when given as spirit of camphor by the mouth, in appropriate dosage: from 1 to 10 drops; to an infant, $\frac{1}{4}$ drop in hot water. To an adult, camphor should be given hypodermically, dissolved in sterilized olive-oil, 1 to 10; one, two, or three syringefuls of 20 to 30 minims each may be given, as needed. Hypodermic injections of ether are sometimes useful. To children alternate hot and cold douches may be applied. The ammonium preparations are useful in nearly all cases. The aromatic spirit of ammonia, ammonium carbonate, ammonium chloride, or ammonium salicylate may be chosen. A good formula for an adult consists of:—

℞ Ammonium chloride, 10 grains.
Ammonium carbonate, 5 grains.
Fluid extract of coca, 1 fluidrachm.
Spirit of nitrous ether, 20 minims.
"Essence of pepsin," 1 fluidrachm.
Water, or
Solution of ammonium acetate, sufficient to make $\frac{1}{2}$ fluidounce.

Dose: Tablespoonful ($\frac{1}{2}$ fluidounce) every two, three, or four hours.

The coca in this formula, while it is useful as a heart-tonic and diuretic, is used primarily merely to disguise the ammonium taste, and the pepsin preparation helps the stomach to bear the medicine. If pleurisy exists, ammonium salicylate may be added to this mixture. Another useful method of giving ammonium carbonate is to dissolve 5 or 10 grains in a dessertspoonful of liquor ammonii acetatis, and put this dose with 15 drops of glycerin and a drachm or two of sherry-wine in a wineglassful of cracked ice. The whole can be swallowed at a gulp, and will often be retained without disturbance of the stomach, when the drug cannot otherwise be given.

Opium need not be given except there be urgent indication to relieve pain or quiet excessive unproductive cough. It should then be used with circumspection. Codeine is usually the best preparation, but, if preferred, the deodorized tincture of opium or the camphorated tincture of opium may be added to the aromatic spirit of ammonia or other ammonium preparation employed. With children, paregoric is usually the best form in which to give opium.

In cases of continued weakness of the heart, not sufficiently urgent to call for the hypodermic use of camphor, tincture of digitalis or Merck's German digitalin may be used in such doses as will produce the effect desired. In tuberculous cases,

especially those with high fever, digitalis may be employed in fairly large doses, as urged by Beddoes, and this use of it sometimes seems to be followed by the happiest results. From 20 to 30 drops of a good tincture may be given to an adult from three to six times a day, until the pulse is reduced to 60 beats per minute; after which sufficient is given, the stomach permitting, to keep the pulse-rate in the neighborhood of 70.

Out of 150 cases of broncho-pneumonia treated by rectal injections of creasote, 125 recovered and only 25 died. If the enemata should not be retained, a few drops of laudanum may be added. The simplest and most practical means of administering the creasote is in milk; the amount of creasote for a child under a year is from 2 to 5 drops night and morning; for an adult, from 30 to 40 and even 50 drops in each enema. The quantity of milk should not exceed an ordinary glassful. The enema should be given warm; if it is evacuated immediately or within a short time, it is necessary to give a second one. If no movement has been produced for a day, the intestine should be emptied with an enema of warm water and glycerin. Schoull (*Jour. des Prat.*, June 12, '97).

Large doses of belladonna valuable in broncho-pneumonia in children. Out of about sixty cases treated by this plan only two deaths occurred. In addition to the large dose the extract of the late British Pharmacopœia is especially recommended. This is given in $\frac{1}{4}$ -grain doses, every three or four hours, irrespective of the age of the infant. In a very few cases these doses induce light delirium, which is quickly relieved by lessening the dose. In a large majority there is some flushing of the skin, in some a definite scarlet rash. The children under this treatment are irritable. J. A. Coutts (*Brit. Med. Jour.*, Jan. 28, '99).

Belladonna is of great value in the broncho-pneumonia of children, preceded by $\frac{1}{12}$ -grain doses of calomel every hour until the bowels are moved. The tinct-

ure of belladonna is used, 2 minims being given every hour. In these small doses it is mildly narcotic, it is a heart-tonic, a respiratory stimulant, and it produces dilatation of the superficial capillaries, thus relieving the congested lungs. Most important, however, is that it diminishes the secretion in the bronchial tubes and the pulmonary tissues. The drug is especially applicable when the bronchial secretion is abundant. Hodghead (*Pediatrics*, Sept. 1, '99).

In children, and especially if the symptoms be those of suffocative catarrh, it is well to cause occasional emesis, for which purpose syrup of ipecacuanha, alum in syrup of ipecacuanha or in honey, or, if these fail, apomorphine may be employed. Turpeth mineral has been commended, but I have never used it. Following the emesis there is sometimes much prostration. I have found the inhalation of amyl-nitrite, cautiously administered, of great service at this time; and also when suffocation cannot be relieved by emesis. In such cases, too, some more active expectorant than the ammonium preparations may be continuously necessary; and syrup of senega, squill, or ipecacuanha may be used. In mild cases, a useful mixture is made with 10 minims, each, of syrup of ipecacuanha, aromatic spirit of ammonia, and paregoric, in water, which may be given every second or third hour.

In the broncho-pneumonia of influenza in children the use of emetics is condemned, as being a powerful factor in the production of pulmonary collapse and in the increase of the general prostration. Indication is to use stimulating expectorants early, and to reanimate the innervating powers by means of alcohol, caffeine, and injections of camphorated oil. This treatment must be pursued energetically from the very onset of the attack. Clemente Ferreira (*Revue Men. des Mal. de l'Enfance*, Mar., '95).

In influenza sodium benzoate and cinchonidine salicylate are useful, and are

to be combined with or substituted for other drugs mentioned.

In tuberculosis, the guaiacol salts, carbonate and salicylate, are to be employed; or, if the stomach will bear it, creasote may be given. Creasote carbonate may often be given in large doses when creasote cannot be taken.

As recovery takes place, the medication, whatever it may have been, should be gradually withdrawn. Should resolution be sluggish, it is well to give ammonium iodide, preferably in a vehicle containing pepsin, and followed by a large draught of water. The dose should be small at first, 5 grains for an adult, and gradually increased. The application of hot poultices for a few days is again likely to be useful.

When recovery is unduly delayed the application over the affected areas of mercurial ointment, or of iodine in lanolin (20 grains to the ounce) well rubbed in, often seems to hasten it. Calomel in small, frequently repeated doses for two or three days, just avoiding salivation, is not rarely useful at this time.

Should there be suppression of urine, bloody urine, or albuminuria, it is well to suspend all medication except some bland alkaline diuretic, and take blood, either from the arm, or by wet cups over the kidneys, after which warm (100° F.) physiological saline solution should be introduced either by a vein or under the skin. High irrigation of the colon with hot physiological saline solution (110° F.) may temporarily substitute the venous or subcutaneous infusion. When the condition of the patient is markedly septic or toxæmic, as shown by muttering delirium and general depression, the same measures should be used.

Leeching back of the ears may be the best method of depletion in cerebral cases. When the chief difficulty seems

to be in the circulation, judgment must be exercised, in view of all the circumstances of the case, as to the employment of these measures. If one can be sure that the obstacle to circulation is not merely the weakness of the heart, but that the latter is simply an indication of peripheral difficulty, blood-letting by wet cupping over the chest or even by venesection is justifiable; and the introduction of saline solution may usefully follow. Sometimes the use of nitroglycerin internally suffices.

When the respiratory obstruction seems to be great, as shown by cyanosis, dyspnoea, rapidity of breathing, short, hacking, incessant, unproductive cough, there is no measure so useful as the inhalation of oxygen. At first this must be as nearly continuous as possible. As improvement takes place, the intervals and duration of inhalations are modified accordingly. It is especially in children, in the aged, in cases following the exanthemata, and in septic cases generally that I have seen oxygen save life. Convalescence must be skillfully managed to avoid the development of chronic broncho-pneumonia, or the supervention of tuberculosis in non-tuberculous cases. Food, fresh air, cold-water bathing, and friction of the skin, with perhaps, in some cases, roborant medication by means of iron, arsenic, hypophosphites, and the like, and regulated pulmonary gymnastics meet the indications.

Chronic broncho-pneumonia calls for good general hygiene and nutrition, the application of fly-blisters over the chest, and systematic expansion of the chest by inhalation of compressed air or other efficient means. Internally iodine compounds are to be given. Pills of iodoform; or of iodoform and iron; or of iodoform, iron, and arsenic may be alternated with ammonium iodide or syrup

of hydriodic acid. Small doses are to be given at first, and gradually increased to the point of tolerance. If the cases prove rebellious to this line of management, a sea-voyage should be recommended, and, this failing, change of residence, temporary or permanent; to an altitude in the case of one young and robust; to a warm, but equable, region in the case of the aged.

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PNEUMONIA, CHRONIC INTERSTITIAL. See TUBERCULOSIS.

PNEUMONIA, LOBAR.

Synonyms. — Croupous pneumonia; fibrinous pneumonia; pneumonitis; lung-fever.

Definition. — Pneumonia is an acute infectious disease with a characteristic pulmonary lesion, due to the outpouring, into an extensive portion of the alveolar structure of the lung, of an hæmorrhagic fibrinous exudate.

Symptoms. — The symptoms of acute pneumonia are dependent both upon the local and upon the general infection. The former, however, usually, though not always, predominate. The onset is usually sudden, with a pronounced chill, which is frequently severe and prolonged. Ordinarily it occurs abruptly without any previous warning, but in some instances it is preceded by a day or two of ill health.

In children the chill may be replaced by headache, nausea, marked vomiting, delirium, or convulsions. Less frequently the onset of the disease is gradual, with a prodromal stage lasting from a few days to a week. These prodromes are indefinite, and may be such as accompany any infectious disease, or may be constituted by symptoms pointing to the lungs, such as cough, pain in the chest, or

slight dyspnœa. These symptoms, however, may be due to a pre-existing bronchitis, which in itself may predispose to croupous pneumonia; even in these cases the onset of the pneumonia may be attended with a chill or some marked thoracic symptom. In other cases, however, pneumonia may supervene gradually upon a pre-existing bronchitis, the point of demarkation between the two not being evident.

The fever rises rapidly and lasts from five to seven days, exceptionally terminating earlier and frequently later. Its decline is usually by crisis, and is attended with great prostration; rapid improvement in the condition of the lungs ensues and convalescence quickly follows. Subjective symptoms occur early in the first day, and pain of a distressing character is frequently a prominent symptom. A dry, half-suppressed cough soon occurs, which aggravates the pain and much increases the patient's suffering. Pain is usually referred to the site of the lesion. Respirations are accelerated and somewhat irregular and shallow, being restricted by the pain caused by a deep inspiration. Later in the course of the disease the respiratory movements become very rapid and shallow, owing to the restriction of air-space due to the lesion. The dyspnœa is frequently so great that the auxiliary muscles of respiration are brought into use, while the nasal alæ are distended with each respiratory movement; the face is cyanosed, the cheek upon the affected side is often especially flushed, and the conjunctivæ are suffused. There is usually an expression of great anxiety.

The expectoration upon the second day of the disease becomes characteristic. It is viscid, airless, extremely tenacious, and possesses a peculiar rusty discoloration. Upon the second or third day the erup-

tion of an abundant crop of herpes about the lips and alæ of the nose is to be observed: a symptom often of great diagnostic value in obscure cases. Nervous symptoms present themselves early and in severe cases are never absent. Headache, sleeplessness, and delirium are common manifestations of the disease. Nausea and vomiting, especially at the onset, are of not infrequent occurrence. Diarrhoea occasionally occurs, but constipation is the rule.

The course of the disease varies greatly, being influenced by the age of the patient, his habits and previous condition, as well as by the virulence of the infection. This accounts for the variation in type resulting in the different forms of croupous pneumonia about to be described. These variations are also to be ascribed to differences in the pathological anatomy, and in the character of bacterial infection. As a rule, cases of frank croupous pneumonia are due to infection by the pneumococcus, while the asthenic varieties of the disease are associated with other forms of bacteria, such as the bacillus typhosus, the bacillus of Pfeiffer, or with staphylococcic or streptococcic infection. In sthenic cases fever is invariably present and active, and in uncomplicated cases conforms more or less closely to a distinct type. The pulse is full and bounding and in frequency corresponds to the intensity of the fever.

Statistics of 150 cases of croupous pneumonia. Of these, 80 per cent. presented the characteristic chill, fever, and other symptoms, the disease lasting from 6 to 11 days. The right lung was involved in 60 per cent., the left in 24 per cent., of the cases; both lungs in 16 per cent. In 12 the apex was involved, but in these no cerebral symptoms were present. The initial chill was absent in 14 per cent. of cases occurring in adults. In three cases in old subjects the temperature remained low, never rising

above 100.1°. In 3 cases sudden death occurred, probably due to the action of the toxins upon the heart. Leucocytosis was found in 22 of 30 cases, a marked increase occurring immediately before the crisis; in the cases examined within thirty-six hours after the crisis there was no further evidence of leucocytosis. Elsner (Med. News, Jan. 8, '98).

SPECIAL SYMPTOMS.—Pain is a symptom of great frequency, and is always present when the lesion extends to the periphery of the lung. It is sharp, stabbing, agonizing in character, and is usually referred to the region of the nipple of the affected side. Its possible reflection to other points, however, such as the abdomen or beneath the shoulder-blade, must not be overlooked. It is probably due to the pleurisy associated with peripheral lesions, and for this reason is commonly absent in central and deeply-seated pneumonias. It is aggravated when the patient coughs and upon deep inspiration. Pain occurred as a prominent symptom in 191 of 285 cases at the Philadelphia Hospital.

Case in which abdominal pain and other symptoms in this region were so marked that the diagnosis of appendicitis was made by a consultant, and an operation performed. The autopsy showed pneumonia with empyema, the abdomen being normal. E. Palier (N. Y. Med. Jour., Sept. 16, '99).

The danger of mistaking a case of so-called "abdominal pneumonia" in children for one involving the abdominal organs emphasized. Two cases personally witnessed in which the abdomen had been opened by experienced surgeons, because appendicitis was supposed to be present. This is apt to occur in cases in which the pulmonary physical signs may not be recognizable for several days. An acute onset, with high temperature and the rate of respiration increased out of proportion to that of the pulse, even should suggest pneumonia. J. L. Morse (Annals of Gynec. and Pediatrics, Nov., '99).

A special form of pneumonia must be distinguished, namely: that to which the name "appendicular pneumonia" has been given, owing to the predominance of the symptoms simulating appendicitis. These symptoms only occur in the early stages of the disease, and rarely persist longer than the fourth day. Miraude (Med. Press and Circular, June 5, 1901).

Dyspnœa is a prominent feature. In the early part of the disease it is due to the intense pain that attends deep inspiration; so that as a result each respiratory movement is partly suppressed. Later in the course of the disease, when pain usually ceases to be a marked feature, dyspnœa is to be ascribed to the limitation of air-space due to the pulmonary lesion. Respirations may be increased to forty or sixty, or even higher in the minute. As before stated, the inspirations are extremely shallow, while expiration is accomplished by a grunt. This expiratory grunt was noted in 79 of the Philadelphia-Hospital cases alluded to. Cough is a symptom of great constancy; its presence was noted in 201 of the same series. It is attended with great pain, and is therefore short and half-suppressed. Early in the disease it is hard and unproductive and is probably caused by the lesion and the associated bronchitis. Exceptionally it is slight or even absent altogether when the lesion is limited or latent, as in the aged and in alcoholics, or when the disease develops in those enfeebled by some pre-existing disease. The sputum is characteristic and of diagnostic value. It is viscid and tenacious, so that it adheres to the vessel into which it is expectorated. It is stained with blood and possesses a reddish or yellowish-red color, giving to it the characteristics known as "rusty."

As the disease develops this rusty discoloration becomes more marked, and in some cases the expectoration consists of

pure blood. In the later periods of the disease the sputum becomes more fluid and loses its tenacious, hæmorrhagic character. In the aged and alcoholics the sputum may possess the characteristics known as "prune-juice," being thin and abundant and dark brown in color. In some instances it is greenish in color: a condition demonstrated by von Jaksch to be due to the transformation of hæmoglobin into bilirubin. Prune-juice expectoration occurred in 5 of the cases of the Philadelphia-Hospital series. Expectoration may be absent altogether, especially in children and in the aged. It is not infrequently absent in drunkards. In 37 cases of the Philadelphia-Hospital series its absence was noted. Microscopically the sputum contains numerous red blood-corpuscles variously changed, but the corpuscular elements of the blood may be absent, the discoloration of the sputum under these circumstances being due to the solution of its coloring matter. Leucocytes and swelled, degenerated alveolar epithelium are present. It may also contain fibrinous casts of the smaller bronchial tubes and alveoli. Various bacteria are found upon staining: the pneumococcus, as well as other micro-organisms.

The frequency of the pulse corresponds, as a rule, to the intensity of the fever. Early in the disease it is full, bounding, and tense, and in frequency ranges from 100 to 120. Later, when hepatization is extensive, it becomes feeble, small, and irregular, and occasionally becomes dicrotic. Collapse from heart-failure may occur during the later periods of the disease, when an extensive area of the lung is involved and is especially to be apprehended at the period of the crisis.

Leucocytosis is a marked feature of the disease, but does not invariably occur.

The leucocytes are increased from the earliest periods of the disease and this increase persists during the continuance of the fever. At the time of the crisis the increase in the white cells disappears, the decrease frequently beginning a few hours before its actual occurrence. When defervescence is by lysis, the decline of leucocytosis is more gradual. The number of white cells may vary from the normal to 35,000 or more, as in the case reported by Cabot, in which the count was 94,600. The absence of leucocytosis indicates a very unfavorable prognosis in all but the mildest cases. All the instances in the Philadelphia-Hospital series in which leucocytosis did not occur terminated fatally. Its occurrence, however, is to be regarded as neither a good nor bad sign. In one instance at the Philadelphia Hospital, in which the white-cell count was 37,000, death occurred. The red blood-cells show a slight decrease. This is pointed out by Cabot as being partly due to blood-destruction, as is evidenced by the presence of "hydrobilirubin in the urine and the not infrequent occurrence of jaundice."

Leucocytosis usually occurs both in croupous and in catarrhal pneumonia, varying, however, both in degree and in duration. The leucocytosis is of the active polymorphous variety, the actively amoeboid corpuscles being increased in greater proportion than the other forms. The eosinophile-cells are usually greatly reduced in number. Absence of leucocytosis is, as a rule, an unfavorable sign, and cases in which the number of white cells is normal or subnormal usually terminate fatally. The leucocytosis of pneumonia is the result of chemotactic influences, the toxic substances elaborated by the pneumococcus being positively chemotactic and attracting to the circulation the amoeboid polymorphous corpuscles. In addition there is the reaction of the tissues to the irritant influence of toxic agents. When this reaction does not occur, as when the systemic condi-

tion is bad, then there is no leucocytosis. Alfred Stengel (*Jour. Amer. Med. Assoc.*, Aug. 19, '99).

Study based upon 50 cases of lobar pneumonia. Early in the disease the alveoli contain many cells almost identical in appearance with the so-called transitional cell of the blood. They are usually slightly larger than the polynuclear leucocyte, and contain an irregular vesicular nucleus, surrounded by a rim of protoplasm, containing either a few granules or none at all. In a case in which death occurred eleven hours after onset, there were great numbers of these cells in the exudate and no polynuclear leucocytes. Large phagocytic cells are found in all stages of the disease, but in greatest number in gray hepatization. The inclusions consist chiefly of polynuclear leucocytes and lymphocytes, more rarely of red blood-corpuscles. These phagocytic cells probably play an important part in resolution. Similar cells are found in the lymphatics, in the pleural exudate, and in the bronchial lymph-nodes. The fibrin is not formed by a degeneration of the alveolar epithelium, but comes exclusively from the exuded blood-plasma. The lymphatics are involved late in the disease. There is proliferation of the endothelium, and they become distended with cells, serum, and fibrin. Early in the disease there is no infiltration of the interstitial tissue. In patients dying during the second week there is often a great infiltration with lymphoid and plasma-cells. As a rule, the longer the duration of the disease, the greater the number of plasma-cells. J. H. Pratt (*Phila. Med. Jour.*, June 2, 1900).

Anorexia, nausea, and vomiting are not uncommon, and jaundice is of not infrequent occurrence. This, when slight, possesses no prognostic significance, but deep jaundice occurring in the course of the disease is usually an evidence of serious constitutional infection, and occurs only in the severe cases. To these cases the term bilious pneumonia has been applied, and the jaundice is usually associated with vomiting, diarrhoea, tympa-

nites, marked nervous symptoms, and sometimes slight hepatic enlargement. In most cases of pneumonia, as in all acute infectious diseases, the spleen is enlarged. The kidneys are to some extent involved and occasionally an acute nephritis develops. Febrile albuminuria is present in many cases, and occurred in 45 cases of the Philadelphia-Hospital series. There is marked diminution of the chlorides, which is probably due partly to the amount accumulated in the exudate and partly to the diminished intake, the result of the loss of appetite; reappearance of the chlorides takes place during the stage of resolution. Otherwise the urine possesses the ordinary characteristics of febrile urine,—scanty, high colored, and acid in reaction. At the time of crisis it may be markedly increased and shows upon standing a heavy deposit of urates. In cases attended with jaundice the urine presents the evidences of the coloring matter of the bile.

Herpes is of such common occurrence in pneumonia as to possess diagnostic importance. The appearance of this eruption is especially valuable in cases of central pneumonia and in those instances in which the limitation of the lesion may render the diagnosis doubtful. It occurs early in the disease and is usually distributed about the lips and nasal alæ.

The nervous system is frequently disturbed. In mild cases mental dullness, headache, and marked prostration occur. In the severer forms of the disease delirium may be most marked. In most cases these nervous symptoms are due to the infection and not to any pathological changes in the cerebral meninges. In other instances, however, inflammation of the meninges, as demonstrated at the autopsy, accounts for their occurrence. During life the differentiation between the two classes of cases is attended with

much difficulty. Hyperpyrexia is usually associated with those cases in which marked cerebral perturbation occurs. In drunkards an attack of delirium tremens is very apt to characterize the onset of the disease, and as the symptoms of pneumonia may be absent systematic examination of the lungs in such cases is important. In children convulsions may occur at the onset of the disease and may then replace the chill.

Nervous symptoms are perhaps more frequent in pneumonia than in typhoid fever. From the onset the nervous features may so dominate the scene that the local lesion is likely to be overlooked. These cases may be grouped under three headings: 1. The cerebral pneumonia of children, in which the disease sets in with a convulsion; there is high fever, headache, delirium, great irritability, muscular tremor, and perhaps retraction of the head and neck. The diagnosis of meningitis is almost invariably made and the local affection may be overlooked. 2. Cases in which the disease sets in with acute mania. Pulmonary features are frequently masked in those of delirium tremens, and error is certain to occur, unless it is made an invariable rule to examine the chest in such cases. 3. Cases with toxic features, resembling those of uræmia. Without chill, cough, or pain in the side, the patient may develop fever, a little shortness of breath, and then gradually grow dull, heavy, and within three days there may be a condition of profound toxæmia, with low, muttering delirium. Osler (*Maryland Med. Jour.*, Mar. 12, '98).

Fever is almost always present and is more or less typical. Its onset is abrupt, quickly following the chill, and its fastigium is rapidly attained. Its range is high, reaching 104° or 105° F. or higher, and is subcontinuous except when its course is interrupted by the distinct and marked remissions known as pseudo-crises. These remissions are so decided as to lead to the hope that the actual crisis is about to take place; exacerbation of

the fever follows, however, and the disease pursues its course, interrupted, perhaps, by one or more pseudocrises. The duration of the fever varies and in uncomplicated cases usually terminates in from five to nine days. It may, however, cease earlier, more frequently later. Defervescence is usually critical; occasionally, however, it is prolonged and may take place by lysis. In one of the series of cases at the Philadelphia Hospital convalescence did not begin until the nineteenth day, although no complication accounting for the sustained febrile temperature could be detected. Frequently there is a decided rise in the temperature immediately before the crisis; this is the so-called "precritical rise." In cases terminating fatally a so-called preagonistic rise in the temperature may occur, which at times reaches 103 degrees or higher. This preagonistic rise was noted in 9 of the Philadelphia-Hospital cases.

Physical Signs. — **INSPECTION.** — The patient usually lies upon the infected side: a decubitus very likely to be assumed in those instances in which pain is a common symptom. By assuming this attitude the respiratory excursions upon the affected side is limited and the rubbing together of the inflamed pleural surfaces reduced to a minimum. Evidences of dyspnoea are frequently to be observed and the degree of cyanosis and dilatation of the nasal alæ, with the play of the auxiliary muscles of respiration, may constitute an important evidence of the extent to which the air-space is limited. In severe cases cyanosis of the cheeks and lips may be most marked. It is not uncommon for one cheek alone to show cyanosis, and this usually corresponds with the side of the lesion. No alteration in the contour of the chest is to be detected, but increased frequency of respi-

ration is to be noted and limitation of the respiratory movement upon the affected side is often most marked. In the early stages of the disease this limitation is to be ascribed to the involuntary fixation of the chest-wall on account of the intense pleuritic pain. Later, when consolidation has supervened, this lack of expansion is due to inability to expand that portion of the lung. At the onset but little alteration in the vocal fremitus is to be detected. In proportion as consolidation develops, however, vocal fremitus is increased. Early in the disease a pleuritic fremitus is not uncommonly detected. Absence of vocal fremitus must not lead to a rash conclusion of the non-existence of pulmonary consolidation, or that the latter is associated with a pleural effusion, as the voice-vibrations are sometimes temporarily prevented from being transmitted to the lesion by the occlusion of a large bronchial tube with a mass of mucus.

PERCUSSION. — At the time of onset the percussion-note remains clear. As engorgement progresses, however, the note becomes higher in pitch and frequently possesses a tympanitic quality. With increase in the exudation and consequent driving out of the air from the air-vesicles and bronchioles a gradually-increasing degree of dullness supervenes. This dullness, however, even with the most massive consolidation, is never complete, for the reason that the involved area is never totally lacking in air, which continues to pass in and out of the bronchial tubes ramifying throughout the involved area. Associated with dullness is a sensation of increased resistance to the finger. Over that portion of the lung immediately above the consolidated area percussion is apt to yield a note of tympanitic quality resembling the so-called Skodaic resonance. The unaffected por-

tion of the lung and the lung upon the opposite side give hyperresonance upon percussion, owing to the increased function which the limitation of air-space makes necessary for these portions to perform.

New sign which the writer has observed in pneumonia, and one that is nearly always constant. This is a lack of expansion of the subclavicular region of the affected side. This sign, which has been watched for in all affections of the respiratory tract, has been encountered only in pneumonia. In pleurisy and pneumothorax lack of expansion may be noted on the affected side, but it embraces the whole side, and is in direct connection with the seat of the evolution. It may be confined to the base or, if the effusion is extensive, may involve the whole side. In pneumonia, on the contrary, the lack of expansion is confined to the subclavicular region, even—and especially when—the pneumonia affects the base. It is an early sign which is observable from the first day, and lasts often through the whole course of the disease. Weill (*Revue Mens. des Mal. de l'Enfance*, Oct., 1901).

With the beginning of resolution and the consequent resorption of the exudate, dullness progressively diminishes as the air again enters the affected area. A return to the tympanitic quality of percussion-note takes place, however, before the resonance assumes its normal quality. Lesions of limited extent are not always susceptible of recognition by percussion. This is particularly the case in central pneumonia, in which the hepatized portion of the lung is surrounded by uninvolvement.

AUSCULTATION in the early stage reveals diminished breath-sounds, and very shortly the crepitant râle is to be detected, especially at the termination of a full inspiration. In addition to this significant râle various râles, some coarse, some fine, moist as well as dry, are to be

heard over both lungs; these sounds are evidences of the acute bronchial catarrh which so frequently accompanies pneumonia.

When solidification of the exudate occurs the crepitant râle disappears and the breath-sounds become bronchial. Should the main bronchus leading to the consolidated area be obstructed with mucus, however, bronchial breathing as well as râles may be absent. Over the consolidated area the voice-sounds assume those peculiarities known as bronchophony. This may be modified to the extent that the voice-sounds possess the bleating and nasal qualities termed ægophony. During the stage of consolidation numerous bronchial râles, both dry and moist, are usually to be detected. As the exudation undergoes liquefaction with the occurrence of resolution numerous moist râles of marked intensity are to be heard. Bronchial breathing and bronchophony become less and less distinct; and the crepitant râle, somewhat coarser in character than that which has accompanied the stage of congestion, is again to be heard: the crepitus redux. This, however, does not occur in all cases.

Over the unaffected portion of the involved lung, as well as over the unaffected lung, the breath-sounds remain vesicular, but intensified, constituting the so-called puerile breathing.

In central pneumonia bronchial breathing and the crepitant râle may not be detected, for the reason that these sounds are muffled by the surrounding healthy lung.

SYMPTOMS OF ATYPICAL VARIETIES.

PNEUMONIA IN CHILDHOOD possesses characteristics that are somewhat peculiar. The onset is frequently attended by convulsions or marked delirium in place of the chill so often characterizing the onset of the disease in adults. Gastro-

intestinal disturbances, especially vomiting, occur with greater frequency in childhood. Pain is often absent or referred to other portions of the body, and the characteristic rusty sputum is of rare occurrence largely because of the infrequency of expectoration in early childhood. At this period of life, also, the physical signs of pneumonia are often masked, and the frequency with which the lesion occurs at the apex alone has been the source of many errors in diagnosis, its existence being overlooked. As in these cases decided nervous manifestations are usually marked, the necessity for great care in the physical examination of the pulmonary apices is emphasized.

Croupous pneumonia occurs in infants below the age of two years as frequently as, and probably more frequently than, in older children. In infants a diagnosis between croupous pneumonia and broncho-pneumonia with labor consolidation is often impossible, many cases of broncho-pneumonia with labor consolidation appearing in the post-mortem room with a diagnosis of croupous pneumonia. On account of this difficulty statistics based on diagnosis alone are quite untrustworthy, but this error can largely be eliminated by studying autopsy cases. The mortality in croupous pneumonia is largest in the first year of life (25 per cent.), is considerable below at the age of two years (15.4 per cent.), but for children above this age is comparatively small (2.3 per cent). Clive Rivière (*Lancet*, July 18, 1903).

PNEUMONIA OF THE AGED may begin suddenly, but more frequently the onset of the attack is gradual, the initial chill of the ordinary form of the disease being entirely wanting. Nervous symptoms are characteristic of this type of croupous pneumonia. Cough is usually absent and expectoration is slight or of the prune-juice variety. There is profound depres-

sion of vitality and the physical signs are usually ill defined. Pneumonia of the aged is an extremely grave affection.

ALCOHOLIC PNEUMONIA is frequently not manifested by early pulmonary symptoms; chest-pains and fever may be almost entirely wanting, cough may be slight, and the sputum may be abundant and thin, possessing the characteristics of prune-juice sputum; profuse sweating is often a marked manifestation. The fever is but of moderate degree, but marked nervous symptoms are common. The delirium may be of the low, muttering variety or may be wild and maniacal in character; indeed, the disease may be ushered in with all the manifestations of delirium tremens, while the subjective symptoms of pneumonia are entirely absent. This is an extremely grave form of the disease.

TYPHOID PNEUMONIA is a term used to designate both the asthenic forms of pneumonia and pneumonia as it occurs in the course of typhoid fever. In the former class of cases the disease receives this term from the low typhoid condition into which the patient lapses. In these cases nervous symptoms, of a depressed character, are prominent, and low, wandering delirium, ataxic nervous phenomena, intestinal disturbances, tympanites, a dry, coated tongue, and gradually deepening stupor make up a clinical picture the grave significance of which can hardly be overlooked. Symptoms dependent upon the local lesion are frequently lacking and the diagnosis depends upon a systematic examination of the chest. The term typhoid is also frequently employed to designate pneumonia occurring in the course of typhoid fever as a complication, as well as to indicate those instances of so-called pneumotyphus in which the pulmonary lesion

depends upon the early localization of the typhoid bacillus within the pulmonary structure.

PNEUMONIA WITH CENTRAL LESIONS shows some modification of the usual symptomatology. While subjective symptoms may be marked, it will be readily understood that the physical signs are indefinite, so that the diagnosis depends mainly upon the former manifestations. Pain, however, is usually absent, as involvement of the pleura, upon which this symptom usually depends, does not occur. Apical pneumonia, or those cases in which the lesion begins at the apex, is often extremely grave and attended by marked nervous phenomena, particularly delirium. It is to this class of cases that the term cerebral pneumonia is sometimes applied.

Pneumonia occurs with great frequency as an intercurrent affection in a large group of chronic diseases, and is thus encountered during the course of chronic nephritis, diabetes, locomotor ataxia, and other chronic diseases of the nervous system. Under these circumstances it frequently constitutes the ultimate cause of death. In chronic pulmonary diseases, also,—as chronic tuberculosis and emphysema,—the disease at times occurs, and when associated with the latter affection is often of difficult diagnosis, owing to the indefinite character of the physical signs, due to the failure of the inflammatory exudate to completely fill the greatly distended air-vesicles, so that complete consolidation of the involved area does not take place.

Three forms of pneumonia have been described in accordance with the distribution of the local lesion: (1) migratory, or wandering, pneumonia, a form in which one lobe after the other is successively invaded; (2) double pneumonia, in which one or more lobes of both lungs

are involved, but which otherwise shows no special modification of symptoms; and (3) crossed pneumonia, already referred to as that form in which the lower lobe of one side and the upper lobe of the other are involved.

Bilious pneumonia is that form in which marked jaundice is an associated symptom, and is probably due to a mixed infection.

Diagnosis.—The diagnosis of croupous pneumonia is usually unattended with difficulty. The sudden onset with chill, a temperature-curve corresponding to a more or less distinct type, the character of the sputum, the occurrence of herpes, the physical signs, and the sequence of events in general constitute a clinical picture in typical cases that admits of but little difficulty in diagnosis.

In children up to ten years there is often found an absence of the patellar reflex. It can frequently be elicited before auscultation or percussion gives evidence of the disease. In very young infants the phenomenon could not be observed; in the other patients it seemed to make no difference where the process was located or how much of the lung was involved. Most children with positive sign were strong and well nourished and were seriously ill with the disease, showing especially cerebral symptoms with the onset, but no variation during the course. M. Pfaundler (*Münch. med. Woch.*, July 22, 1902).

PLEURAL EFFUSIONS.—The differential diagnosis between croupous pneumonia and pleural effusion is sometimes difficult. This is particularly the case in those instances of pleural effusion in which bronchial breathing and bronchophony are decided physical phenomena. The onset of pleurisy, however, is not characterized by symptoms of the same intensity as attend the onset of croupous pneumonia. The chill is usually not severe: more frequently mere chilliness. The fever describes but a

moderate curve: rarely above 102° F. There is usually less cough and less abundant expectoration, and, of course, the rusty sputum is entirely absent. In pleural effusion the physical examination reveals alteration in the contour of the affected side of the chest, partial effacement of the intercostal spaces, restriction of the respiratory movements upon the affected side, and a possible visible displacement of the apex-beat of the heart; the vocal fremitus, also, is usually absent, while in croupous pneumonia it is increased. Percussion in pleural effusion usually yields a note that is dull or flat; in croupous pneumonia dullness is only partial. Of first importance in the differentiation of these two affections is the position of the adjacent viscera. In left-sided pleural effusion displacement of the heart to the right occurs, and depression of the fundus of the stomach results in the obliteration of the so-called semilunar space of Traube. In right-sided pleural effusion the heart is displaced to the left and the liver is displaced in the downward direction. In pneumonia the adjacent organs undergo no displacement. On auscultation the breath-sounds and voice-sounds in pleural effusion are usually diminished in intensity or possess a very distant bronchial character. In pneumonia bronchophony and bronchial breathing are very marked.

BRONCHO-PNEUMONIA. — Errors in diagnosis sometimes arise in the differentiation between croupous and broncho-pneumonia. The latter, however, lacks the well-developed signs that attend croupous pneumonia and is an affection that involves both lungs. Areas of dullness over which bronchial breathing and bronchophony occur are heard in patches here and there over both lungs. The onset is less abrupt and the evidences of pulmonary involvement are usually pre-

ceded by well-defined symptoms of bronchitis. There is an absence of rusty sputum; the disease is of longer duration and the termination is gradual and not attended by the well-marked crisis that so frequently characterizes the defervescence of croupous pneumonia.

PNEUMOTYPHUS. — The differential diagnosis between croupous pneumonia and the cases of so-called pneumotypus is often difficult and, indeed, may be impossible. It is only after repeated examinations and the final appearance of the characteristic symptoms of typhoid fever that the distinction can be made.

ATYPICAL FORMS OF PNEUMONIA. — The difficulties of diagnosis in cases of central pneumonia, in pneumonia as it occurs in emphysema, in alcoholic pneumonia, in pneumonia in the young and aged, and in pneumonia when it occurs as an intercurrent affection in other diseases have been already referred to. The knowledge of the deviation from the type which the disease assumes under these conditions should prove sufficient to keep one constantly on guard against a possible oversight of the existence of the lesion, for in many of these cases it is only by systematic and routine examination of the chest that the true condition of affairs can be arrived at.

ACUTE PNEUMONIC PHTHISIS. — To distinguish between croupous pneumonia and acute pneumonic phthisis is sometimes difficult. In the latter affection, however, the more gradual onset, the tendency of the fever to be remittent in type and attended with repeated chills, or chilliness; the profuse sweats; the rapid emaciation and abundant expectoration which, as the lung breaks down, shows the presence of tubercle bacilli; the location of the lesion, which is usually at the apex; and the absence of herpes, all serve to differentiate the con-

dition from croupous pneumonia. Of course, the diagnosis of the true nature of the affection becomes apparent when there supervenes upon the stage of consolidation the evidences of pulmonary breakdown.

NEUROSES.—The frequent association of croupous pneumonia with marked nervous symptoms at times causes confusion between this disease and meningitis. The importance, therefore, of physical examination of the chest in all cases simulating meningitis cannot be too strongly insisted upon, and in this examination the pulmonary apices must not be overlooked.

Etiology.—In its geographical distribution pneumonia is a wide-spread affection. It prevails in all climates, and in this country is said to progressively increase as one passes from the arctics to the tropics. It occurs during all seasons of the year, but especially during the winter and early spring months. From the statistics of Aufrecht, Magdeberg-Alstadt, of 1501 cases, 544 occurred between January 1st and March 31st; 462 between April 1st and June 30th. In cold weather attended with changes of temperature the predisposition is greater than during prolonged cold.

Pneumonia may occur at any age, but may be considered to be of infrequent occurrence for the first five years of life, during which period the inflammatory conditions of the lung are more apt to appear in the form of broncho-pneumonia. It is of common occurrence between the twentieth and fortieth years of life, after which age there is a period of comparative lessened liability until the sixtieth year, when of all acute diseases pneumonia claims the largest number of deaths. An analysis of 285 cases admitted to the Philadelphia Hospital between January 1, 1897, and July 1, 1899,

divided into the various decades of life, gives the following results:—

1—10	10—20	20—30
4	10	44
30—40	40—50	50—60
55	43	46
60—70	70—80	over 80
54	26	2

Sex in itself offers neither immunity nor causes any special predisposition to croupous pneumonia. In early infancy and childhood, when the sexes are subject to the same environment, the liability to croupous pneumonia is equal. It is only when the active period of life is attained and the two sexes live under different conditions that there is a greater prevalence of pneumonia among the male than among the female sex. Again, when advanced age brings the two sexes once more under the influence of the same external conditions one shows but little liability over the other. Of the 285 cases at the Philadelphia Hospital 210 were males and 75 females; of course, the number of males admitted to the institution largely exceeds the number of females.

Occupation entails no special liability to the disease except as it may be attended by exposure to conditions which are in themselves predisposing. Pneumonia is of more frequent occurrence among the poor and those who live under bad hygienic surroundings than among the well-to-do. Depressed influences of all kinds, both mental and physical, may be considered as of predisposing importance. Thus, alcoholism, both acute and chronic, is a very important factor in the etiology of croupous pneumonia, both on account of its lowering effect upon the organism in general and on account of the exposure that is apt to attend a debauch. It is these cases and

those instances occurring in individuals the subjects of already existing disease which constitute, as a rule, the so-called asthenic forms of pneumonia, the sthenic types of the disease usually occurring in young and healthy robust adults. Convalescence from other acute illnesses must also be regarded as a predisposing factor. Individuals the subjects of malarial infection are supposed to possess a peculiar liability to the disease. That some people possess an individual predisposition to pneumonia must not be overlooked, and one attack of the disease, so far from creating an immunity, appears to predispose the individual to subsequent attacks. The importance played by cold as a cause of pneumonia was formerly much exaggerated. At one time regarded by many as the exciting cause of the disease, it is now considered but one of a number of predisposing influences. That this is the true relation of exposure to cold to the etiology of croupous pneumonia is warranted by the fact that in a considerable proportion of cases no history of such exposure can be traced.

The frequency with which the affection follows traumatism, especially of the chest, has been commented upon. Thus Litten (*Zeit. f. klin. Med.*, vol. xxvi, '82) in a collection of 320 cases of pneumonia found 4.4 per cent. due to injury. Of the cases at the Philadelphia Hospital already alluded to, but 2 gave a history of traumatism.

Injury alone cannot produce inflammation of the lungs, but acts by raising the virulence of the pneumococci already present, and by decreasing the resistance of the tissues. Pézerat (*Gaz. Hebdom. de Méd. et de Chir.*, No. 61, '98).

EXCITING CAUSE.—Pneumonia is an infectious disease due to a number of micro-organisms, of which the most frequent is Fränkel's pneumococcus, or the

diplococcus pneumoniae. That it is a general infection with a localization of the infecting principle in the lung, through which the specific toxin gains entrance to the general system, and not a local disease, is evidenced by the fact that there is no constant relation between the amount of tissue involved in the local lesion and the intensity of the symptoms. Thus, a limited pulmonary lesion may be attended by high fever and great general disturbance, while an extensive consolidation may be associated with mild pyrexia and slight constitutional disturbances. Further, the course of croupous pneumonia, as in all infectious diseases, conforms to a more or less distinct type, and the frequency with which the disease prevails in epidemic form is further proof of its infectious character.

The diplococcus pneumoniae first demonstrated by Fränkel and Weichselbaum to have pathogenic properties when inoculated, is frequently found under normal circumstances in the upper air-passages. It is not to be regarded as the exciting cause of croupous pneumonia alone, as in recent years its presence has been demonstrated in other diseases. Its existence has thus been discovered in many of the complications of croupous pneumonia, as in pleurisy, pericarditis, peritonitis, meningitis, ulcerative endocarditis, and nephritis; and in the absence of croupous pneumonia it is the exciting cause of a number of inflammatory processes, especially cerebro-spinal meningitis.

According to Netter (*Compt.-rend. de la Soc. de Biol.*, No. 34, '87), the organism can be found in the saliva in 20 out of 100 normal individuals, and its presence has frequently been demonstrated in the nasal secretions. It is not, therefore, by inhalation that the diplococcus

causes pneumonia; it must rather first enter the circulation and by means of the blood become colonized in the lungs. From this point further distribution by the circulation takes place and a general toxæmia results.

While recognizing that the discovery of the pneumococcus enables us to look upon croupous pneumonia as an infectious disease depending upon the action of this organism, the manner in which the micro-organism brings about the local and general condition remains unexplained. Although the pneumococcus may find its way into the blood- and lymph- vessels, the most likely channel of infection is by the air-passages. This view is sustained by the well-known fact that two-thirds of the cases of foreign bodies passing down the trachea find their way into the right bronchus, pneumonia being common on the right side. A. H. Smith (Med. Rec., Jan. 2, '97).

Frequency noted with which pneumonia follows ether anæsthesia. The infection probably takes place from the mouth to the lungs through the air-passages. The exudation shows numerous micro-organisms, especially the pneumococcus. Whitney (Boston Med. and Surg. Jour., Sept. 23, '97).

Statistics collected of 12,842 etherizations, 30 of which were followed by pneumonia. Careless exposure to cold, etc., will not explain all cases. The theory that infection takes place from the mask or cone used is not supported by facts, as in hospitals, where a fresh sterilized towel was used, the percentage of pneumonia was not less than that where a fixed apparatus was employed. Some weight may be attributed to the fact that mucus from the nose and throat, being drawn into the trachea during narcosis, may predispose the patient to an attack of pneumonia. Anders (Univ. Med. Mag., Aug., '98).

Analysis of 200 cases of pneumonia showed marked susceptibility on the part of certain families to the malady. The cases of croupous pneumonia showed the left lung to be affected nearly twice as frequently as the right. Influenza was the most frequent antecedent in the cases

of secondary pneumonia. The general mortality was 9 per cent., and the extremes of life furnish almost the entire number of fatalities. C. Z. Weber (Phila. Med. Jour., Sept. 29, 1900).

Although Fränkel's diplococcus or, as it is sometimes called from its frequent shape, the diplococcus lanceolatus, is the most frequent cause of croupous pneumonia, it must be borne in mind that the disease occurs as the result of infection with other forms of bacteria, and that the resulting pulmonary lesion is in no way to be differentiated anatomically from the changes produced by infection with Fränkel's organism. Friedländer's bacillus, streptococcic and staphylococcic infection, as well as the bacillus of Pfeiffer, are thus to be regarded as capable of producing croupous pneumonia. Similar changes have also recently been demonstrated to be due to infection with the bacillus typhosus of Eberth, so-called pneumotyphus, and, so far as the anatomical pulmonary changes are concerned, there are no points of differentiation from the changes produced by pneumococcic infection.

Series of experiments showing that the intratracheal injection of the pneumococcus, or other bacteria alone, was insufficient to cause the pneumonia, but that such resulted when irritating dust also was injected. Dürck (Deut. Archiv f. klin. Med., June, '97).

The micro-organisms peculiar to erysipelas, to influenza, to tuberculosis, and to enteric fever may one and all give rise to a specific pneumonia or pneumonic fever. So also may Loeffler's diphtheria bacillus and the bacillus of malignant anthrax, as well as other pathogenic bacteria. J. W. Moore (Brit. Med. Jour., Jan. 1, '98).

Pathological Anatomy.—The characteristic lesion of croupous pneumonia is to be found in the lungs, and is due to the deposit of an extensive fibrinous, hæmorrhagic exudate in the bronchioles and alveolar structure of the lungs. The

lesion may involve one or more lobes to their whole extent, and, although it not uncommonly extends beyond the lobe, it is at times limited by the fibrous septa. The lower lobes are more frequently involved than the upper, and the right side oftener than the left. The upper lobes are sometimes alone involved and occasionally the right middle exclusively. The lesion frequently involves both sides, and the simultaneous implication of the lower lobe on one side and the upper lobe of the other constitutes what is known as crossed pneumonia. It is for the reason that one or more lobes are involved that the term lobar pneumonia is applied to the disease. As the result of this exudation the tissue of the lung is changed from an air-containing structure into one that is airless except in the larger bronchi.

In the series of 285 cases at the Philadelphia Hospital the lesion was distributed as follows:—

Right lower lobe.	Right middle lobe.	Right upper lobe.	Right middle and lower lobes.	Right middle and upper lobes.
83	3	24	20	9
Right upper, middle, and lower lobes.	Left lower lobe.	Left upper lobe.	Left upper and lower lobes.	Right and left lower lobes.
20	59	14	18	3
Right and left upper lobes.	Right upper and left lower lobes.	Left upper and right lower lobes.	Right upper and middle and left upper lobes.	
4	4	3	3	
Right upper, middle, lower, and left upper lobes.	Right upper, middle, lower, and left lower lobes.	Left lower and upper and right upper lobes.		
4	5	8		

In one additional case that died twenty-four hours after admission each lung was consolidated from apex to base and the autopsy showed that everywhere the lesion was in the same stage, so that this involvement of both lungs in their entirety must have taken place almost simultaneously.

The anatomical changes pass through three stages: (1) the stage of engorgement, or congestion; (2) the stage of red hepatization, or consolidation; and (3) the stage of gray hepatization, or resolution. While these stages are more or

less distinct, it must be understood that frequently in the same lung the three stages of the process may be existent at the same time.

In the stage of *engorgement*, or *congestion*, the lung becomes intensely hyperæmic, is dark red in color, and is markedly œdematous. The air, while diminished, is not absent from the air-vesicles. In this stage the alveoli are filling up with an abundant exudate, which is hæmorrhagic, but still fluid, so that the cut section upon pressure exudes a frothy serum, the lung-structure itself readily breaking down under the finger. Microscopically the capillaries are found to be dilated and tortuous. The alveolar epithelium is swelled and the alveoli contain free epithelium and white and red blood-corpuscles. While this stage may continue for several days, its usual duration is about twenty-four hours.

In the stage of *red hepatization*, or *consolidation*, the lung is deep red in color

and is swelled to such a degree that upon its surface is frequently observed the indentations produced by the ribs. Its weight during this stage is greatly increased. The surface of the cut-section presents a finely granular appearance and it is now completely airless and sinks in water, while the tissue is extremely friable and readily breaks down under pressure. With a knife a tenacious, grayish-red fluid can be readily scraped off and from the small bronchi may thus be detached minute casts formed of coagulated exudate. On microscopical examination

the contents of the alveoli are found to contain coagulated fibrin, red blood-corpuscles, leucocytes, and granular epithelium.

The stage of *gray hepatization* develops gradually from the second stage of the anatomical process. The faintly-mottled appearance that characterizes the lung during the stage of red hepatization has now become more marked. The tissue remains solid, but this characteristic is less marked. The cut surface becomes smoother, losing its granular appearance as liquefaction of the alveolar contents takes place. Toward the end of this stage there is some re-entrance of air; so that upon pressure crepitation may be elicited. The fluid scraped from the cut section at this time is more abundant and is more milky in appearance, and in its general characteristics resembles pus. For this reason this stage has sometimes been called that of purulent infiltration. Microscopically the fibrinous exudate is found to have broken down, the red blood-corpuscles have disappeared, having become discolored or undergone absorption, while a marked increase in the number of leucocytes is to be observed. It is probably the absorption of the coloring matter of the red blood-corpuscles and the increase in the number of leucocytes which brings about the change in color of the lung in these two stages of the anatomical process.

The rejuvenation of the lost alveolar epithelium results from that which has survived, and ultimately entire restitution of the pulmonary tissues takes place. The three stages thus briefly described occupy no more than seven to ten days, and are accompanied by a plastic pleurisy which in the area of its distribution corresponds more or less closely to that of the pulmonary lesion, when it extends to the periphery of the lung.

Although the usual termination of croupous pneumonia is in resolution, failure of complete restitution of the lung-structure to the normal frequently takes place. We find, therefore, that the purulent infiltration which succeeds upon the third stage may at times terminate in gangrene, and occasionally in abscess which may be either single or multiple. Of course, these conditions result from infection with secondary forms of bacteria. Again, resolution may be delayed, in some instances eventually returning to the normal, but in others never doing so, so that subsequently the involved area undergoes chronic fibroid change, the ultimate termination of which is occasionally in tubercular infection. This, however, is not to be regarded as due to any condition inseparable from or essential to the pneumonic process, but as dependent upon secondary infection with the tubercle bacillus.

A catarrhal bronchitis is frequently associated with croupous pneumonia, especially in the portions of the lung not directly involved by the lesion. The peribronchial and tracheal glands are frequently enlarged and softened. The heart is found to be distended with blood and clots of firm consistency, which are frequently withdrawn from the organ with some little difficulty owing to their entanglement among the trabeculæ. Distension of the right side of the heart with clots is especially marked. Pericarditis occurs not infrequently, and is apt to be associated with left-sided and double-sided pneumonia rather than with pneumonia of the right side. Pericardial exudation, which is frequently abundant, shows the presence of the pneumococcus. Ordinarily this exudation is fibrino-serous, but is occasionally purulent. Endocarditis is a more frequent complication of pneumonia than pericarditis, and not

infrequently is of the ulcerative type, showing the presence of the pneumococcus. Leptomeningitis is of not very frequent occurrence and usually happens in those cases also the subject of a malignant endocarditis. Meningeal inflammation in its distribution is usually cortical and in the exudation the pneumococci are frequently found. The spleen frequently undergoes enlargement, as in other infectious diseases, and is usually soft in consistence. Granular degeneration of the liver with extreme congestion of the organ is frequently to be observed. Parenchymatous degeneration of the kidneys also occurs.

Complications and Sequels.—Pleurisy is a constant accompaniment of croupous pneumonia whenever the pulmonary lesion reaches the periphery of the lung. In the vast majority of instances the involvement of the pleura results in a dry, plastic pleuritis, but in some cases a serous exudation occurs. The signs of effusion under these circumstances may be masked, and a positive diagnosis of the condition difficult without resort to aspiration. Owing to the resistance offered by the consolidated lung to the accumulating fluid, a very moderate effusion may lead to serious displacement of the adjacent viscera, particularly the heart. Its recognition under these circumstances is, of course, important, as aspiration may be necessary to relieve serious embarrassment of the circulation. Occasionally the effusion is purulent: an occurrence usually denoted by persistence of the fever and by the existence of marked leucocytosis. This is not an infrequent complication, statistics showing it to occur in about 1 per cent. of the cases. It has happened in my experience to see pulsating empyema a complication of pneumonia. Whether the effusion be serous or purulent, bacteriological exam-

ination of the exudate will usually discover the presence of the pneumococcus.

Out of 1331 cases of pneumonia occurring in Guy's Hospital from 1883 to 1898, empyema developed in 45 cases, or 3.3 per cent. The temperature is the best guide in the diagnosis of empyema; there is a fall of temperature at the pneumonic crisis, with a subsequent rise in about one-third of all the cases. In many cases there is no apyrexial interval, and pus may be present from quite early in the illness. In other cases pericarditis and malignant endocarditis may prevent the fall of the temperature to normal after the crisis of the pneumonia. In no case did a single aspiration stop the pyrexia and formation of pus, even in the cases where the pneumococcus was the sole organism found. Of the 45 cases, 13 died: a mortality of 29 per cent. The extra danger to life in pneumonia, complicated by empyema, is not very great. W. Hale White (*Lancet*, Nov. 10, 1900).

Pericarditis occurs in a considerable proportion of the cases, more particularly when pneumonia involves the left lung. It was found by Osler to occur in 5 per cent. of the cases. It is commonly fibrinous, although there may be considerable effusion, usually serous, but which in severe cases may be purulent. Usually the presence of the pneumococcus can be demonstrated in the exudate. Endocarditis is of more frequent occurrence and there is a marked tendency for the involvement of the endocardium to assume the malignant form. From the statistics collected by Osler 25 per cent., or 54 out of 209 cases of malignant endocarditis, occurred in pneumonia. It occurs more commonly in the left side of the heart than the right, and particularly attacks those the subjects of chronic valvular disease. Pneumococci may be found in the vegetations.

Rare case in which, in the course of lobar pneumonia, the signs of a malignant endocarditis manifested themselves associated with septic temperature, hy-

perpyrexia, and chills, though without any heart-murmur. At autopsy large thrombotic excrescences, the size of one's thumb, were found on the tricuspid valve. The other valves were free. Cultures gave a lanceolate diplococcus, positive to Gram, but larger than the usual Fraenkel-Weichselbaum organism. Finley and Wyatt Johnston (Phila. Med. Jour., May 7, '98).

Too much stress cannot be laid on the occurrence of pericarditis during the course of the pneumonia; it is often overlooked because of the insidious development of the complication. Without pain, but with only an increase in the pulse-rate, one is feebly warned of the development of this associated process. The physical signs alone enable us to distinguish pericardial infection. However, stress is to be laid on the importance of watching the pericardium, noting the physical signs there, for, in the large majority of instances, it is too late when the physician first learns of this complication by symptoms of great effusion when operative measures must be resorted to. J. H. Musser (Jour. Amer. Med. Assoc., Aug. 26, '99).

Acute nephritis occurs in a small proportion of cases. It was a complication in 8 of the series of cases at the Philadelphia Hospital. Parotitis is a very infrequent complication, being observed in but 1 of the 285 cases occurring at the Philadelphia Hospital.

Out of a series of 500 cases of pneumonia, parotitis was met with only once. A review of the literature elicited in all 18 cases (personal case included), from the study of which the following conclusions are drawn:—

The complication is met with in all ages, more commonly in males. It usually appears with the defervescence, whether by crisis or by lysis. The side involved bears no constant relation to the seat of pulmonary lesion.

Both parotid glands were involved in 4 out of the 18 cases, the involvement being successive. Incision and evacuation of pus were necessitated in 5 cases. One evacuated spontaneously. The pus was examined bacteriologically in only

3 instances. In 1 case pneumococci were present. The staphylococcus pyogenes aureus was found in this case, as well as in the 2 remaining ones. Death resulted in 3 cases, all of which were complicated: 1 by cystitis, 1 by endocarditis, 1 by endocarditis and empyema. In none of these cases of parotid bubo was there apparently any reason to suspect that the glandular enlargement was due to the specific infection of mumps. None of the cases evinced any tendency to contagiousness, there being no involvement of the testes or mammæ, and suppuration occurred frequently.

The channel of infection was probably through Stensen's duct, although it is possible that a blood-metastasis occurred in Scott's case, in which pneumococci were found. Parotid bubo is, broadly speaking, an uncommon condition, and why an attack of croupous pneumonia should predispose to infection of the gland through its duct does not seem evident. Cases also reported by Talley and Gittings (Phila. Med. Jour., Mar. 28, 1900), Coleman (Phila. Med. Jour., Apr. 29, 1900), Anders (Phila. Med. Jour., May 26, 1900), Robison (Phila. Med. Jour., May 26, 1900), Eshner (Phila. Med. Jour., Feb. 16, 1901), Miller (Phila. Med. Jour., Mar. 16, 1901), Holladay (Phila. Med. Jour., May 12, 1900), Morris (Phila. Med. Jour., Mar. 16, 1901), and are referred to. G. W. Morris (Phila. Med. Jour., Apr. 27, 1901).

Meningitis is an occasional complication. It occurred in but 1 of the above mentioned 285 cases, but in 8 per cent. of the fatal cases reported by Osler.

Among the rare complications may be mentioned peripheral neuritis, arthritis, hæmorrhage from the mucous membranes, and hæmaturia. One attack of croupous pneumonia does not confer immunity against subsequent attacks; on the contrary, in no other acute disease is recurrence so likely to take place.

Attention called to rare complication of phlegmasia alba dolens in pneumonia. Three cases treated under observation and six collected from the literature.

Of the 9, 5 were on the left side, 2 on the right, and 2 were bilateral. The prognosis is favorable, though the recovery may be tedious. The usual seat of the lesions is in the internal saphenous or in the femoral vein, or in both. J. M. Da Costa (Phila. Med. Jour., Sept. 10, '98).

Among the sequels of pneumonia abscess may occur from purulent infiltration of the lung-tissue. It is not of frequent occurrence, and shows itself by the expectoration of large quantities of purulent material, containing pulmonary elastic tissue. As the abscess increases in size the signs of a cavity become manifest. Gangrene of the lung is not a frequent sequel. It occurred in but 2 cases in the 285 at the Philadelphia Hospital. It reveals its existence by the horribly offensive odor of the expectoration and by the presence of elastic tissue, as well as by symptoms indicating constitutional infection. Resolution of the lung following pneumonia may be delayed, with final return to the normal condition. In some cases, however, the integrity of the lung may never be re-established. In these cases chronic fibroid changes may occur, resulting in marked retraction of the chest-wall.

Seven hundred and fifty undoubted cases of genuine fibrinous pneumonia that have been treated in the Berlin City Hospital in the 7 years between 1890 and 1897 studied. There were 11 cases of abscess-formation following pneumonia; that is, in 1.5 per cent. of the cases. In 5 cases the pneumonia was complicated by empyema. Three cases presented outspoken gangrene. Induration of the lung occurred in 16 cases; that is, in 2.1 per cent.

There were 15 instances in which pneumonia and tuberculosis were present in combination, but in none of these were there evidences that the tuberculosis was caused by the pneumonia. Serous pleurisy was present in 8.7 per cent. of the cases; empyema in 4.5 per cent., and this became putrid in 4 cases. Bac-

teriological examination of the pus from the empyema in 26 cases disclosed the presence of pneumococci in 19 instances, 4 times in conjunction with streptococci. In the other cases streptococci and staphylococci were found. Fourteen cases were fatal. In 3 instances purulent mediastinitis complicated the pneumonia, and in all these cases pneumococci were found. Purulent pericarditis occurred in 7 cases, and these also yielded pneumococci. Bacteriological examination of the blood was made in 48 cases, and yielded negative results in 36; in 27 of the latter recovery ensued, while in 9 death. Twelve cases yielded positive results, and, of these 12, but 2 patients recovered. Of the 9 fatal cases in which the blood-examination yielded negative information, 4 were instances of double pneumonia and of the other 5 cases 3 were apex-pneumonias, 4 of the 5 patients being alcoholics and the fifth an aged woman. Endocarditis was seen 6 times as a complication. In 4 cases it was of verrucose form. In 5 cases cultures were made from the exudate upon the valves, and in 3 of these pneumococci were found in pure culture. Acute nephritis was observed in 6 cases also. Meningitis occurred in 5 cases, and in each case the pneumococcus was found in the exudate. Hans Sello (*Zeit. f. klin. Med.*, B. 36, H. 1, 2, '98).

Lesions due to pneumococcic embolism should be suspected when, during an attack of pneumonia, vision of one or both eyes is impaired. Several cases have been reported by Fraenkel and two personal ones in which ophthalmoscopic examination revealed lesions of various structures. In one of these there was evidence of recent chorioretinitis involving the region around the optic disk, in which were seven large, rounded, ill-defined, light-gray prominent spots. A. Peters (*Klin. Monats. f. Augenheilk.*, May, 1901).

Prognosis.—The prognosis of croupous pneumonia varies greatly in accordance with the conditions with which it is associated. Under all circumstances a grave affection the death-rate is highest among those already debilitated by pre-

existing disease, in alcoholics, and in the aged. In children and in robust young adults the prognosis is more favorable than under other conditions. In general, the death-rate may be said to be about 25 per cent. In the Philadelphia-Hospital series of 285 cases, in the majority of which the most unfavorable conditions of previous ill health, alcoholism, and complications were uncounted, the fatal cases numbered 147, a percentage of 51.9. The association of the disease, therefore, with any complication renders the prognosis graver. A very serious complication is endocarditis, either acute or chronic, while its association with chronic cardiac disease other than valvular, with pulmonary emphysema, with alcoholism, and its occurrence in the aged offer an unfavorable outlook. Meningitis as a complication gives an absolutely unfavorable prognosis. A lesion at the apex is more serious than when it occurs at the base, and, of course, the prognosis is graver when an extensive portion of the lung is involved. Double pneumonia, therefore, is a graver affection than when the lesion is limited to one lung or to one lobe of the lung.

Analysis of 10,000 cases of pneumonia treated in the London Hospital showing that the quantity of albumin in the urine is of considerable prognostic value and that those cases which commence with a severe gastro-intestinal attack are twice as liable to end fatally as those which exhibit the more usual initial rigor. The mortality of the disease was shown to be directly proportionate to the severity of the symptomatic fever. Fenwick (*Lancet*, Jan. 31, '91).

The pulse in the evening frequently takes on in pneumonia the hesitating character shown on the sphygmograph by a broken ascending line. This phenomenon is easily perceptible to the touch in severe cases of pneumonia. Its prognosis is very grave: it coincides with feeble arterial tension and cardiac

failure due to myocarditis. Carrière (*Progrès Méd.*, June 24, '99).

Prognosis depends on (1) age, being grave in the very young and old; (2) race, negroes the most readily succumbing; (3) habit, the intemperate or those suffering degenerative changes being less able to withstand the infection; (4) toxæmia; (5) fever; (6) general pneumococcic infection; (7) location and extent of pathological changes; (8) complications; and (9) the kind of infection. The prognosis is better in cases infected by pneumococcus than by streptococcus or mixed infection. Death is most often from heart-failure, in which the greatest factor is toxæmia; and the next is the excessive cardiac strain due to mechanical interference with the circulation and respiration. The absence of leucocytosis means grave prognosis or mild infection. Christopher Graham (*Northwestern Lancet*, March 1, 1901).

An examination of the blood may afford valuable information as regards the prognosis. The significance of leucocytosis under these circumstances is thus summarized by Cabot: "In the prognosis the important point is that the absence of leucocytosis is a very bad sign, while its presence is neither good nor bad." It must be remembered, also, that in the very mildest cases we may find the same absence of leucocytosis which in any other but the mildest would be almost surely fatal. In the Philadelphia-Hospital cases death occurred in all in which leucocytosis was absent, while it also occurred in a case in which the leucocytes numbered 37,000.

The prognosis in those cases of croupous pneumonia in which leucocytosis is not present is very unfavorable. Von Jaksch (*Centralb. f. klin. Med.*, Feb. 6, '92).

Well-marked leucocytosis in lobar pneumonia, while in itself a favorable sign, does not assure that the disease will pursue a favorable course, but indicates usually a severe infection. A moderately-low degree is an extremely-unfavorable sign. In severe cases ab-

sence of leucocytosis indicates, with rare exceptions, that the disease will prove fatal. Most cases of lobar pneumonia in which the lesion extends to the pericardium and peritoneum are attended with slight leucocytosis. Ewing (*N. Y. Med. Jour.*, Dec. 16, '93).

Of 48 cases in which the blood was bacteriologically examined after Littman's method, in 36 cases there was a negative result, and in 12 a positive. Of the 36 cases in which the result was negative, 7 terminated fatally, while, of the 12 with a positive result, 10 were fatal cases. It thus appears that if pneumococci are found in the blood it is probable that the case will terminate fatally. H. Sello (*Zeits. f. klin. Med.*, B. 36, p. 112, '99).

Death takes place in pneumonia as a result of failure of the heart, whether brought about by the action of the specific toxin of the disease or due to the gradual distension of the right ventricle, dependent upon the hepatization of the lung.

General death-rate for pneumonia considered to be 20 to 30 per cent. Above the age of 60 the mortality is from 50 to 80 per cent., while young people are prone to recover. The same is the case in robust healthy adults; for instance, the death-rate in the German army in over 40,000 cases was only 3.6 per cent. General debility, poor food, and alcoholism greatly increase the danger. Toxæmia is the most common cause of death; the symptoms may develop early and cause from the outset severe cerebral symptoms. The toxæmia may be severe and fatal, even with consolidation of only one-half a lobe, being, in reality, due to the action of the specific toxins on the heart-centres rather than on the muscular substance of the organ itself. The toxæmia outweighs all other elements in the prognosis of pneumonia. Osler (*Amer. Jour. Med. Sci.*, Jan., '97).

Treatment.—Pneumonia is to be regarded as a disease that runs a more or less typical course and as being self-limited. Of late, efforts have been made to treat the disease by the blood-serum of

animals that have been rendered immune to the toxic influences of the pneumococcus. These experiments have been largely carried out by F. and G. Klemperer, but the effort of Welch (*Med. Rec.*, May 14, '98) to confirm the experiments of the Klemperers has not been attended with marked success. He found that it was extremely difficult to demonstrate a toxin in the blood from those who had recovered from pneumonia, and that it is not true that an antitoxin appears in the blood at the time of the crisis of pneumonia, but, on the contrary, at that time the toxin is stronger, so that 1½ cubic centimetres of the blood from a person convalescing from pneumonia three or four days after the crisis is rapidly fatal in small amounts to rabbits. It is also claimed by Vaughan (*Med. Rec.*, May 14, '98) that the pneumotoxin was preventive of pneumonia but to a slight degree, and this only temporarily so, the result depending upon the amount of leucocytosis that existed at the time. He further states that there is no promise at the present time of making the pneumotoxin of therapeutic effect.

It is extremely doubtful if medicine influences in any way the course of pneumonia. The treatment, therefore, must be regarded as one of expectancy, with active treatment of symptoms as they arise. At the outset it must be stated that everything should be done to maintain the patient's strength, and that no medication should be resorted to that tends in the slightest way to embarrass the action of the heart. Such drugs, therefore, as aconite, veratrum viride, and the coal-tar antipyretics have none but a harmful influence.

Protests against the indiscriminate use, in cardiac asthenia of pneumonia, of remedies that lower the vitality while they reduce the temperature, especially veratrum viride, which is more used in

America than elsewhere, and tend to paralyze the vasomotor centres and dilate the arteries. Such remedies as strychnine, digitalis, sparteine sulphate, and caffeine, together with diffusible stimulants and Tokay wine, advocated. H. L. Elsner (Trans. Amer. Climat. Assoc., vol. xv, '99).

The frequency with which blood-letting was formerly resorted to calls for a word of caution. Only with great rarity is resort to this measure of treatment permissible. It is only in those cases of the so-called sthenic type in the young, robust adult attended with great activity of the circulation and full, tense pulse, cyanosis, and embarrassment to respiration that venesection should be employed, and then only in the early part of the disease. The result of blood-letting is but the alleviation of these symptoms; it has no effect upon the course of the disease, nor does it influence the extension of the lesion. Late in the course of pneumonia, when the right side of the heart appears to be greatly embarrassed, dyspnoea and cyanosis marked, with evidences of pulmonary oedema, as a last resort venesection may be employed. Very little is to be expected from it, however, and the alleviation of symptoms is but transitory.

There are two periods in the treatment of croupous pneumonia in which blood-letting might be of service: First, in the early stage for the relief of pain and dyspnoea, and, second, in the advanced stage where there is engorgement of the right heart, also associated with intense dyspnoea, cyanosis, and general venous stasis. For the first stage the writer recommends especially blood-letting by wet-cupping, although venesection at the arm is also efficient. The other measures for the relief of pain—such as poultices, counter-irritation, and even full doses of morphine hypodermically—are comparatively valueless for this purpose. It is especially in cases of pneumonia associated with pleu-

risy—pleuro-pneumonia—that this measure is of signal service. The second period in which blood-letting is useful is in an advanced stage where there is engorgement of the right heart, which is unable to relieve itself of its burden because the lung is already engorged with blood which it cannot get rid of. This condition is indicated by intense dyspnoea; frequent, shallow breathing; and cyanosis. The blood-letting required is venesection, and it is especially valuable when associated with the subcutaneous injection of normal salt solution and with oxygen inhalations that its results follow. The writer is certain that he has seen life saved by the prudent use of venesection under the circumstances. As to blistering, it is serviceable for the most part only in delayed resolution. James Tyson (New York Med. Jour., July 19, 1902).

Fever is a symptom frequently requiring treatment. For this purpose, however, medicinal antipyretics must not be employed. The greatest benefit will be found to accrue from the use of the various hydrotherapeutic measures at our command. Cold, therefore, in its various forms may be used, either as the cold sponge, in the form of cold compresses, or in the application of the ice pack to the affected side. Should the temperature be persistent and its range high, with marked intensity of nervous symptoms, the patient may be put into the full plunge-bath with the temperature of the water at 70° or 75° F. The systematic use of the cold bath, however, in croupous pneumonia has not been attended with beneficial results.

Ice recommended in treatment of croupous pneumonia. The affected area—front, side, and back—continuously surrounded with rubber ice-bags well wrapped in towels. An ice-bag is also placed on the head, and from $\frac{1}{20}$ to $\frac{1}{25}$ grain of strychnine given by the mouth every three or four hours, with an injection of $\frac{1}{30}$ grain of the same drug once a day until its physiological action

becomes apparent in restlessness. This may, perhaps, be first observed in the lower extremities. A tablespoonful of beef-powder in chocolate or coffee is a most valuable food in these cases, when given every three hours. Mays (*Med. News*, Jan. 21, '93).

Cold water highly recommended in the treatment of pneumonia in children. A. Jacobi (*Archives of Ped.*, Apr., '93).

There is danger of cold baths to infants with pneumonia, unless the technique be exact. Baths of 95° F. should be used, reduced not lower than 80° F. from ten to fifteen minutes, with friction. Baruch (*Archives of Ped.*, July, '93).

In the Children's Hospital, Philadelphia, every patient with pneumonia receives a warm tub-bath at the outset, if the general condition permits of it. If not, he is sponged. He is then confined absolutely to bed. On the theory that croupous pneumonia, and probably broncho-pneumonia as well, is an infectious disease, no abortive or specific treatment is attempted. Should fever reach 104° or over, sponging with water of 70° or 80° is often employed, or a warm tub-bath is given. If the temperature of the child is still higher, the temperature of the water is reduced, or a cool tub-bath is given. When the respiration is becoming much embarrassed, the heart failing, and the general strength waning, a plunge from one to three minutes into a bath of 103° to 105° will often rouse the failing powers in a remarkable manner. Cotton jacket personally not employed. When there is much dyspnoea or pain, a hot, light poultice sometimes gives great relief. Counter-irritation is used occasionally, oftenest in the form of turpentine stupes to relieve pain. Griffith (*Archives of Ped.*, Apr., '96).

Cold bath used in 36 pneumonia cases in the Boston City Hospital. The baths were given very much as in typhoid fever, although they were not kept up so long, the duration generally being about ten minutes. Of the 36 cases, 28 recovered and 8 died, giving a mortality of 22.2 per cent. In the same hospital there had been treated 355 cases of

croupous pneumonia, with a mortality of 34.9 per cent., and this was about the average death-rate at that hospital. Of the 8 fatal cases, 1 had typhoid fever also, 1 had pleurisy, 3 had chronic alcoholism, 1 had general diplococcic infection (endocarditis, pericarditis, and meningitis), 1 had chronic nephritis, and 1 had phthisis.

In all but one case alcoholic stimulants were used. Folsom (*Amer. Medico-Surg. Bull.*, Dec. 19, '96).

In pneumonia in children little treatment is necessary in most cases; but, whatever is done, a child with a temperature of 104° or 105° F., and respiration at 60 should not have a hot poultice tightly wrapped about its chest. Particular attention should be paid to the condition of the digestion and diet. Fresh air is also an essential. The restlessness and nervous symptoms should be relieved by the cold pack, care being taken to keep the extremities warm by means of hot bottles. W. P. Northrup (*Med. News*, Nov. 19, '98).

In the pneumonia of children the application of water is the safest and most satisfactory method of controlling dangerous hyperpyrexia. In order to be effectual, the cold to the head must be thoroughly and continuously applied. Finely-cracked ice placed in bladders may be molded around the head, especially at the vertex and occiput. Ice poultices made by mixing finely cracked ice with flaxseedmeal in oiled silk, placed around and on top of the head, are most valuable. Compresses may be applied directly to the chest. The child is stripped, wrapped in a blanket, and placed upon a table. A stimulant is given, and the feet are placed in contact with hot bottles. A compress sufficiently large to surround the chest is plunged into water at a temperature of from 70° to 95° F., and applied to the chest. This is changed every ten or fifteen minutes until desired result is obtained. In order to disturb the child as little as possible, the nurse is directed to apply the compress from the front, tucking in the ends until they meet in the back. Addition of about one-fourth part of alcohol some-

times increases the value of these compresses. When the temperature is reduced to 102° or 103° F., the compresses should not be renewed, but are kept in position in case the temperature ascends again to an unsafe degree. In case of cyanotic children, with prostration and hyperpyrexia, the warm bath (100° F.) with friction of the surface has been applied with good results. Henry Dwight Chapin (*Med. News*, Nov. 19, '98).

Treatment of infantile pneumonia should be governed by the age of the patient, the severity of the infection, the extent of the pneumonic process, and the condition of the heart. Rapidity of the heart-beat indicates vigorous cardiac stimulation. For this purpose digitalis in 1/2-minim doses and strychnine in doses of 1/400 grain are most useful. In cases of acute cardiac failure hypodermics of alcohol are most valuable. Poultices are never to be employed. Opium is always contra-indicated. Baths are well borne in sthenic cases with hyperpyrexia. The temperature should be 85° at immersion, subsequently reduced to 75°. Baths, however, should never be repeated if they cause any weakening of the pulse. Alcohol is only used where there is cardiac weakness. Attention called to necessity for isolation, free ventilation, and the presence of the vapor of thymol, turpentine, or creasote in the atmosphere. Koplik (*Med. News*, Nov. 19, '98).

Treatment of pneumonia in children: (1) Hygienic: fresh air. (2) Dietetic: avoiding indigestion and flatulence. (3) Hydropathic: baths or packs. Poultices, for pain only, should be used intermittently. Heart-stimulants—strychnine, nitroglycerin, alcohol, digitalis—when needed. Antipyretics (coal-tar products) are mentioned only to condemn them absolutely. W. P. Northrup (*Med. Age*, Oct. 25, '99).

Nine cases of lobar pneumonia treated by the ice pack (dry cold over the seat of the lesion), supportive and symptomatic treatment being used in addition. But one death occurred, in an old man of sixty, on the second day. All the cases were well marked or fairly severe,

a good leucocytosis being present in all except the fatal case. In only one case was discomfort caused, and in none was there any danger of collapse at the crisis. High temperature is the indication for the application, and lowered temperature for its removal. G. L. Collins (*Boston Med. and Surg. Jour.*, March, 1901).

Three remedies meet the indications presented by the circulatory changes due to paralysis of the vasomotor centers, the dilated condition of the arteries and the weakened heart. These are strychnine, digitalis, and suprarenal extract, or adrenalin, its active principle. Adrenalin acts on the heart and blood-vessels favorably; it does not act on the vasomotor centre. Hence, it may be used to assist strychnine. When the vasomotor centre is exhausted and blood-pressure study proves the inefficiency of strychnine, adrenalin may still be administered, and, in some cases which seem unpromising, when combined with the method of stimulation about to be suggested, we may carry the patient beyond the critical period to a safe recovery. H. L. Elsner (*N. Y. Med. Jour.* and *Phila. Med. Jour.*, Jan. 2, 1904).

To maintain the heart's action is one of the most important indications in pneumonia. Of the remedies used for this purpose alcohol is one of the most important, but it should not be given in a routine manner. When the heart-sounds become enfeebled, with a small pulse associated with low arterial tension, alcohol is strongly indicated. This remedy is especially valuable in those persons who have had an alcoholic history, and its administration in large doses may be necessary to avert an attack of delirium tremens. It will thus be seen that the amount of alcohol required in any case will vary, so that the dose is to be regulated by the effects produced. As supplementary to alcohol the sulphate of strychnine is of great value. It is best given subcutaneously, and its use should be restricted to such occasions when it is

necessary to tide the patient over a critical period. It should be reserved, therefore, for those periods in the course of the disease when the patient's heart seems to be failing, and should not be given unless definitely indicated.

Of great value is nitroglycerin in doses of $\frac{1}{100}$ grain repeated every two or three hours as indicated. By the use of this drug the peripheral resistance to the laboring heart is greatly lessened, and much of the strain placed upon this organ in its efforts to force the blood through the consolidated lung is removed by thus effecting the dilatation of the capillaries generally.

In some cases of pneumonia the outcome seemed to depend entirely upon the ability of the right heart to move the mass of blood through the lung. These cases were marked by dyspnoea, cyanosis, and a generally congested condition of the vascular system. The right side of the heart would be found, on percussion, to be enlarged and there would be decided accentuation of the pulmonary second sound. In this class of cases nitroglycerin is of value. With increasing experience, more and more confidence is felt in strychnine as a cardiac stimulant. A. H. Smith (Med. News, Apr. 30, '98).

With the same object in view, Hayem recommends the use of amyl-nitrite in large doses by inhalation, and employs compresses upon which 15 drops of the pure drug are placed and held close to the nose and mouth while deep inspirations are being made. This may be repeated so that 50 drops are administered in the course of five hours. He advises the continuance of this treatment for a few days beyond defervescence.

Other remedies of value are the aromatic spirit of ammonia, carbonate of ammonia, and, in instances of sudden heart-failure, the administration of ether hypodermically. In other cases sulphate of atropine administered hypodermically

will be found of distinct advantage in stimulating a flagging heart.

Creasote has recently been highly recommended.

A large number of circulars were sent by the writer asking the following questions of those who had used creasote or carbonate of creasote in the treatment of pneumonia: 1. Do you believe creasote ever aborts pneumonia? 2. Do you believe the majority of cases are mitigated by it? 3. Have you ever found cases which, having plenty of time, were entirely uninfluenced by it? In response he had over seventy letters and cards and five oral statements, a large proportion of which are tabulated. For the first question 37 physicians, reporting 762 cases, said "Yes"; 15, reporting 187, said "No"; and 19, reporting 177, failed to answer. Therefore, of those reporting, a little over two-thirds admitted the abortive effects of creasote. To the second question, 57, reporting 1022 cases, answered "Yes"; 2, reporting 10 cases, said "No"; and the remainder failed to answer. To the third, 23 said "Yes," 31 "No," and 10 failed to answer. The answers showed that a large percentage of cases of pneumonia can be cut short or aborted; almost all the rest are mitigated, and the remainder, or a very small percentage, are not affected by the remedy. Among the answers was one from W. H. Thompson giving his experience in the Roosevelt Hospital, which shows a striking contrast in the mortality with and without its employment. The use of carbonate of creasote or creasote in the treatment of pulmonary affections is one of the greatest recent life-saving discoveries. I. L. Van Zandt (Medical Record, Oct. 18, 1902).

The feature of the method of treatment of pneumonia by the method suggested some time ago by French clinicians consists in the effort to overcome the toxæmia, which is usually the most serious element in a case of pneumonia. The toxic symptoms are best combated by means of large and increasing doses of creasote. The remedy must be pushed to tolerance. An important part of the

intoxication in pneumonia that weakens the patient and renders the prognosis more unfavorable comes from the absorption of poisonous products from the intestinal canal. An important accessory feature of the treatment then is the administration of intestinal antiseptics and the maintenance of the intestinal canal, as far as it may be possible, in a state of asepticity. The most important etiological factor and mortality from pneumonia is undoubtedly the toxæmia. The results obtained with direct antitoxic treatment have been most encouraging. R. W. Wilcox (Medical News, Feb. 8, 1902).

The writer advises that judicious, rational treatment should be begun immediately and continued during the attack. The most useful *single agent* in treatment, as preventive and curative, is creosote, used preferably as inhalations, properly given and continued for a sufficient length of time. Strict avoidance of extremes of treatment in any direction should be observed, whether it be toward the use of so-called specifics or the employment of certain drugs, notably digitalis and strychnine. It should be graven on the mind that pneumonia may be throttled or minimized most surely in the beginning. Later, when the disease is fully developed, our rôle is inferior, but should consist mainly in doing least harm. Harm proceeds almost invariably from ignorance or undue enthusiasm. Beverly Robinson (American Journal Medical Sciences, Dec., 1904).

Treatment of pneumonia by large doses of digitalis has been strongly advocated by Petresco. This is a revival of the treatment first advocated by Traube and in which as much as 120 grains are administered in the course of forty-eight to sixty hours. Petresco claims that no ill-toward effects are caused by the use of the drug in these large doses, that if administered at the onset it will shorten the duration of the disease, and that in any event it is attended by a marked lowering of the death-rate. As pointed out

by Aufrecht, however, as low a death-rate has been obtained by other methods of treatment. Thus, of 379 cases between the ages of fifteen and twenty years, taken from his series of 1501 cases, 11 terminated fatally: a mortality of 2.64 per cent. The same author quotes a series of cases reported by Risell in which, of 127 cases occurring in individuals in the second and third decades of life, only 2 terminated fatally, or a mortality of 1.8 per cent. The treatment in these cases was without digitalis. The danger of causing nausea and vomiting or producing the cumulative effects of digitalis is sufficient to militate against the use of the remedy, especially as it has not been clearly demonstrated that as good results are not obtained from other methods of treatment.

A symptom requiring treatment is pain. For its relief the subcutaneous administration of morphine may be resorted to. Should this prove objectionable, opium in some other form, as Dover's powder, may be administered by the mouth. The same measures of treatment are indicated for the relief of the distressing cough which is so apt to increase the patient's suffering.

Much relief may be experienced from these symptoms by the application of an ice-bag to the affected side. Early in the course of the case counter-irritation to the affected side may be employed, or a few leeches or wet cups may be applied. Care must be taken, however, that blood shall not be withdrawn in sufficient quantity to cause any depression. If sleeplessness occur the administration of chloral may give relief. If there be headache or other marked cerebral symptoms, an ice-cap to the head should be used, and if these symptoms are attended with hyperpyrexia the administration of a cold bath may be advis-

able. In severe cases where the lesion is extensive and attended with decided dyspnoea and cyanosis some relief of these symptoms may be obtained by the free administration of oxygen. The use of this remedy is also frequently attended with improvement of the nervous symptoms, and appears in some cases to lend strength to the heart's action.

One hundred cases of pneumonia treated with only one death. To all of these cases was administered salicylic acid, sometimes alone, sometimes in combination with other remedies. From 8 to 10 grains every two hours were employed. Salicylic acid believed to be specific for lobar pneumonia. C. Sebring (Med. Record, Apr. 22, '99).

A series of cases of broncho-pneumonia in children successfully treated with large doses of belladonna, no other medication being required. Of several dozen patients so treated only 2 died. Stress is laid on 2 points: 1. The amount given should be large. 2. The tincture of belladonna is not to be used, but preferably the extract. The dose is $\frac{1}{4}$ grain every 3 or 4 hours. This dosage applies equally to infants and older children. J. A. Coutts (Brit. Med. Jour., No. 1987, p. 207, '99).

The intravenous injection of saline solutions has in the hands of some given good results. Bassi (Gazz. degli Osped., June 6, '96) reports 6 cases of severe acute pneumonia treated after the method of Galvagni by the endovenous injection of a solution of chloride and bicarbonate of sodium. In each case the pneumonia was double and of the grave type, and of the 6 cases 5 recovered and 1 died. It is claimed that the best time to give the injection is about a day before the expected crisis, or when the pulse becomes intermittent, or upon any grave alteration in the condition of the patient. A small preliminary bleeding is held to be useful.

Three very grave cases of pneumonia treated by means of infusion of salt solu-

tion combined with oxygen inhalations. Personal view that salt solution dilutes the toxins in the blood, relieving delirium, etc., and that it promotes their elimination through the sweat-glands and kidneys. It lowers the temperature, stimulates the heart, lowers the rate of respiration, and renders the breathing less labored. It also renders the patient more susceptible to the influence of oxygen. C. A. Penrose (Johns Hopkins Hosp. Bull., July, '99).

Any tendency to collapse at the time of the crisis must be carefully watched, and it may then be necessary to apply external heat and to administer diffusible stimulants by the mouth or subcutaneously. It should be borne in mind that pleural effusion associated with croupous pneumonia, even though the amount of exudate be small, may give rise to serious pressure symptoms. Early resort to aspiration of the pleural cavity in such cases must be resorted to.

Diarrhoea, which frequently occurs in croupous pneumonia, calls for no special treatment, and constipation, should it occur, is readily overcome by the administration of calomel or a saline.

The diet throughout should be systematically administered and only such articles of food as are of ready assimilation should be given.

An antipneumococcic serum has recently been proposed by Pane, but experience with it has so far been insufficient to warrant an estimate of its value.

The treatment with antitoxic serum as still in the experimental stage. The serum used has been obtained from the blood either of patients convalescent from pneumonia or of animals treated by gradually increasing doses of cultures of the pneumococcus. The more encouraging results have been obtained by the former method. Eichhorst (Ther. Monats., Feb., 1900).

The pneumonia serum at present does

not seem to shorten the duration of the disease, nor cut short the pneumonic processes in the lungs, nor bring about the desired "crises." But it does seem, in certain cases, to prevent a general pneumococcic septicæmia, and thus in these cases it may save life. Alexander Lambert (Jour. Amer. Med. Assoc., Apr. 14, 1900).

In the German Hospital, in Philadelphia, the antipneumococcic serum was used in 18 cases of croupous pneumonia, but not to the exclusion of other treatment. After the injections the temperature became lower, the pulse slower, the pain less, and the patient felt better. Four of the patients died. But the duration of the attack did not seem to be lessened or the defervescence hastened. In a series of 20 cases treated at the Pennsylvania Hospital at the same time without serum 4 died. J. C. Wilson (Boston Med. and Surg. Jour., June 14, 1900).

A sufficiently extensive trial of the antipneumococcal sera has been made to determine with a reasonable degree of accuracy their efficiency and the results, as a whole, fail to carry conviction. An efficient serum, or one that will cut short the pneumonic process, is yet to be produced, although according to some clinicians, the sera available at present have a restricted field of usefulness. Recent observers have employed the serum in massive doses from the commencement of the disease without gratifying results. The practical results of the use of the antipneumococcus serum, as shown by the very slight reduction in the mortality percentage, does not warrant its general introduction. The sera thus far found possesses no antitoxic qualities, and their supposed anti-infectious properties have not been proven. J. M. Anders (Journal American Medical Association, Dec. 10, 1904).

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PNEUMONOKONIOSIS.

Definition and Varieties.—This is a term applied to the proliferative interstitial inflammation of various pulmo-

nary structures caused by the continued inhalation of dusts of different kinds. The three principal forms of pneumonokoniosis are *anthracosis*, or coal-miners' disease, due to the inhalation of coal-dust; *chalicosis*, or stone-cutters' phthisis, brought on by the inhalation of mineral dusts; and *siderosis*, due to the inhalation of iron oxide and other metallic particles. Clinically, pneumonokoniosis may be considered as a combination of chronic bronchitis, emphysema, and phthisis, which not infrequently assumes the tuberculous type.

Symptoms.—The manifestations of the three forms of pneumonokoniosis are practically similar. Three stages may be distinguished. During the first there is general uneasiness, anorexia, loss of flesh, paroxysmal cough, and expectoration, varying to a degree, in color, with the kind of dust inhaled. In anthracosis the sputa are black, in chalicosis they are grayish black, while in siderosis they are red. In all three forms hæmoptysis usually occurs, but this symptom is more frequently observed and the hæmorrhages are likely to be more copious in chalicosis. Auscultation shows that the vesicular breathing murmur is lessened during this stage, while vocal resonance is enhanced; sibilant râles are usually detectable. The signs of chronic bronchitis become clearly defined during the second stage, and dyspnœa and vomiting are now added to the symptoms already outlined. The sputa not only show their characteristic coloring, but they become muco-purulent, while the hæmoptyses become relatively more frequent and copious. Symptoms of emphysema are now superadded, and the dyspnœa becomes asthmatic in character. The third stage is characterized by rapidly-increasing anæmia; cavities may then usually be detected, along with all

the symptoms of pulmonary tuberculosis, with all its attending manifestations, night-sweats, diarrhoea, hectic fever, intense dyspnoea, and copious expectoration in which the tubercle bacillus is often found, and the patient succumbs. The third stage may not be reached, however, if the patient is relieved of the exposure to the causative elements in time; on the other hand, the usual manifestations may be replaced by those of some other local disease, particularly lymphosarcoma or other malignant growths of the lung.

Etiology.—Anthracosis not only occurs among coal-miners, but also among laborers who inhale much coal-dust. Molders of bronze, iron, and copper also suffer when coal-dust is employed by them. Chalicosis is observed among stone-cutters and potters particularly. Siderosis occurs in those who inhale iron filings and the oxide of iron, polishers, gold-beaters, and other crafts in which iron is more or less utilized.

Pathology.—The inhalation of air thickly laden with the foreign agents mentioned, after a prolonged period of exposure, gradually weakens and finally overcomes the physiological functions calculated to protect the bronchial mucosa. The ciliated epithelium, the phagocytes, and the mucous and alveolar cells represent as many structures upon whose integrity these functions depend. When these cannot be performed, the mucous membrane of the respiratory tract is penetrated and the foreign bodies invade the lymph-spaces, which represent a second barrier and are capable of disposing of comparatively enormous quantities of intruding substances. When this line of defense is overcome, however, many particles are carried to the lymph-nodes surrounding the bronchi and the blood-vessels and to the

interlobular septa under the pleura, where they accumulate between the tissue-elements, and, through the larger lymph-channels, to the substernal, bronchial, and tracheal glands, in which the stroma-cells of the follicular cords dispose of them permanently and prevent them from entering the general circulation (Arnold, quoted by Osler). When the pigmented bronchial glands become adherent to the pulmonary veins, however, the foreign particles may invade the general circulation and be found in remote organs, the liver and spleen especially (Wiegert).

When the limit of tolerance is reached, an interstitial sclerosis begins in the bronchial glands and periarterial lymph-nodes. These gradually harden, and coalesce until large fibroid areas—cirrhotic masses—are found in various parts of the organ. Post-mortem, such masses, when cut, are quite resistant, and sink in water and color it black. The fingers of the operator become blackened likewise, the cut surfaces appearing either black or marble-like. The bronchi are seldom found dilated, but the finer arterial supply is often obliterated, and cavities are formed, mainly through the arrest of nutrition. The pleura is often thickened and lesions of the right heart are often observed (Dieulafoy).

Treatment.—Unless removal to hygienic surroundings early in the history of the case can be carried out, pneumokoniosis progresses steadily. Anthracosis advances slowly, but chalicosis is usually fatal after three or four years. In siderosis the duration of life is somewhat longer. If the patient cannot be removed elsewhere and finds himself obliged to continue his occupation, the wearing of appropriate masks or respirators may stay the progress of the disease.

Free ventilation of shops, mines, etc., is also prophylactic in this particular; but total change of occupation is the only absolute protective. The disease is often arrested when this can be done. Iodide of potassium and the measures indicated in chronic bronchitis (*q. v.*) have given excellent results when hygienic surroundings are within the reach of the patient.

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PNEUMOPERICARDIUM. See PERICARDIUM.

PODOPHYLLUM. — Podophyllum, U. S. P. (mandrake, or May-apple), is the rhizome and rootlets of *Podophyllum peltatum* (nat. ord., *Berberidæ*): a plant indigenous to the United States and Canada. This plant contains about 4 per cent. of resin, a coloring principle,—saponin,—gum, starch, gallic acid, fixed oil, salts, etc. It contains no distinctive alkaloid; berberine, however, is present. The active principle, according to Podwissotsky, is a neutral crystalline body,—picropodophyllin,—which exists in combination with picropodophyllic acid; the resulting combination he calls podophyllotoxin.

Podophyllotoxin occurs in small, whitish-yellow lumps or powder, having a very bitter taste, and is soluble in alcohol, ether, chloroform, and hot water, but is precipitated from alcoholic solutions by cold water in excess.

The official resin of podophyllum consists, in reality, of two resins: one is soluble in both ether and alcohol, the other only in alcohol. The former, present to the extent of 75 to 80 per cent., is the active part. It occurs in light-yellow powder or in small, yellowish, bulky, fragile lumps, having a faint odor

and an acrid, bitter taste. The resin is very irritating to the eyes and may cause conjunctivitis.

Preparations and Doses. — Podophyllum, U. S. P. (seldom used), 5 to 20 grains.

Extractum podophylli, U. S. P. (solid extract), 1 to 5 grains.

Extractum podophylli fluidum, U. S. P. (fluid extract), 5 to 15 minims.

Resina podophylli, U. S. P. (resin), $\frac{1}{8}$ to 2 grains.

Pilulæ catharticæ vegetabiles, U. S. P. (vegetable cathartic pills: compound extract of colocynth, 1 grain; extracts of hyoscyamus and jalap, of each, $\frac{1}{2}$ grain; extract of leptandra and resin of podophyllum, of each, $\frac{1}{4}$ grain; oil of peppermint, $\frac{1}{8}$ grain), 1 to 5 pills.

Podophyllotoxin, $\frac{1}{12}$ to $\frac{1}{8}$ grain.

Poisoning by Podophyllum.—Podophyllum, or podophyllotoxin, in large doses is a drastic cathartic; in toxic doses it causes violent gastro-enteritis, with vomiting, excessive purging, violent abdominal pain, and collapse or convulsions.

The treatment consists of opium to relieve the pain and check peristalsis, stimulants to sustain the patient, and demulcent drinks to soothe the irritated mucous membrane. Other indications will be afforded by the symptoms in each case.

Therapeutics.—Podophyllum is a useful cathartic in constipation when the glandular secretions of the intestines and liver are deficient. Habitual constipation due to impaired action of the muscular coat of the bowel may be removed by the nightly use of a small dose of the resin, $\frac{1}{4}$ to $\frac{1}{2}$ grain, combined with the extract of belladonna, $\frac{1}{4}$ grain, and the extract of physostigma, $\frac{1}{4}$ grain (Bartholow). Bleeding hæmorrhoids caused by stasis in the portal cir-

culation, if of recent formation, may sometimes be cured by a full dose of podophyllum ($\frac{1}{2}$ to 1 grain). Podophyllum is useful in a variety of hepatic disorders: in functional hepatic disturbances, portal congestion, and catarrhal jaundice. The digestive disturbances of malarial infection may be relieved by a podophyllum purgation. Sick headache associated with loose and dark-colored stools are amenable to podophyllum.

The smallness of the dose and slight taste of the resin make it serviceable in the treatment of constipation in young children or in diarrhoea due to diminished secretion. When hard, stony stools occur in children one or two months old, a grain of the resin may be dissolved in a drachm of alcohol (or spirit of ginger) and 2 drops or more of this on sugar may be given once or twice a day. In the summer diarrhoea of children, with watery passages having a musty or mousy odor, the resin may be given in doses of $\frac{1}{60}$ to $\frac{1}{50}$ grain repeated each few hours. In these small doses the resin will often stop vomiting if the liver is torpid and the stomach depressed. It is obvious that it should not be given if the vomiting is due to gastric irritation or inflammation.

POLIOMYELITIS. See SPINAL CORD.

POLYPUS. See NASAL CAVITIES, EXTERNAL EAR, UTERUS, etc.

POTASSIUM.—Potassium, or kalium, is a white metal, discovered by Sir Humphry Davy in 1807, having the consistence of wax; the fresh-cut surface has a silvery lustre, rapidly changing by oxidation to bluish or gray. Its affinity for oxygen is very strong. Exposed to the air, it oxidizes instantly. Thrown upon water, it takes fire spontaneously,

and burns with a beautiful purple flame, yielding an alkaline solution of potassa, or potassium hydrate. Potassium hydrate, or potassa, is a strong alkaline base, very deliquescent, and soluble in half its weight of water. From this base the medicinal preparations are made. The metal is never used in medicine. Some of the preparations are strongly alkaline and have a high diffusive power; this group contains potassa, potassa with lime, potassium carbonate and bicarbonate. A second series is neutral in reaction and alkaligenous (become alkaline by decomposition, the vegetable acid being replaced by carbonic acid, and an alkaline carbonate being formed); this group contains potassium acetate and citrate, of high diffusive power, and potassium and sodium tartrate and potassium tartrate, of low diffusive power. A third series is permanently neutral or acid; this group contains potassium bitartrate and sulphate, of low diffusive power, and the nitrate, chlorate, bichromate, and iodide, of high diffusive power.

Upon a therapeutic basis, another useful classification may be made.

Caustics: potassa, potassa with lime, and potassium bichromate.

Purgatives: potassium bitartrate (4 to 8 drachms), potassium and sodium tartrate ($\frac{1}{2}$ to 1 ounce), the acetate (2 to 4 drachms), and the sulphate ($\frac{1}{2}$ to 4 drachms).

Systemic antacids: the carbonate (10 to 30 grains), the bicarbonate (20 to 60 grains), the solution of the citrate (1 to 8 drachms), the acetate ($\frac{1}{4}$ to $1\frac{1}{2}$ drachms), and the tartrate of potassa and soda (20 to 40 grains).

Diuretics: the bitartrate (1 to 2 drachms), the tartrate of potassa and soda ($\frac{1}{2}$ to 1 drachm), the acetate ($\frac{1}{4}$ to 1 drachm), the citrate ($\frac{1}{4}$ to 1 drachm), the carbonates ($\frac{1}{8}$ to 1

drachm), the nitrate ($\frac{1}{6}$ to $\frac{1}{2}$ drachm), and the iodide ($\frac{1}{12}$ to 1 drachm).

Febrifuges: the solution of the citrate (1 to 8 drachms), the citrate (20 to 30 grains), and the nitrate (10 to 30 grains).

Alkaline lotions: solutions of the carbonate and the bicarbonate (1 to 2 drachms to 1 pint).

Anti-emetic: the citrate of potassa ($\frac{1}{4}$ to 1 drachm).

Preparations and Doses.—Potassa, U. S. P. (potassium hydrate, or hydroxide; caustic potash).

Liquor potassæ, U. S. P. (solution of potassa, 5 per cent.), 10 to 30 minims.

Potassa cum calce, U. S. P. (Vienna paste or caustic—potassa, 50 per cent.; lime, 50 per cent.).

Potassa sulphurata, U. S. P. (sulphurated potassa; liver of sulphur), $\frac{1}{2}$ to 5 grains. (See SULPHUR.)

Potassii acetas, U. S. P. (acetate of potash), 10 to 60 grains.

Potassii bicarbonas, U. S. P. (bicarbonate of potash), 10 to 60 grains.

Potassii bichromas, U. S. P. (bichromate of potash), $\frac{1}{10}$ to 1 grain.

Potassii bitartras, U. S. P. (bitartrate of potash; cream of tartar), 1 to 8 drachms.

Pulvis jalapæ compositus, U. S. P. (potassium bitartrate, 65 per cent.; jalap, 35 per cent.), $\frac{1}{4}$ to 1 drachm. (See JALAP.)

Potassii bromidum, U. S. P. (bromide of potash), 10 to 60 grains. (See BROMINE.)

Potassii carbonas, U. S. P. (carbonate of potash), 10 to 30 grains.

Potassii chloras, U. S. P. (chlorate of potash), 5 to 10 grains.

Trochisci potassii chloratis, U. S. P. (chlorate of potash, 5 grains), 1 to 5 troches.

Potassii citras, U. S. P. (citrate of potash), 15 to 60 grains.

Liquor potassii citratis, U. S. P. (solution of citrate of potash), 1 to 8 drachms.

Potassii citras effervescens, U. S. P. (effervescent citrate of potash), 30 to 90 grains.

Potassii cyanidum, U. S. P. (cyanide of potash, 90 per cent.), $\frac{1}{8}$ to $\frac{1}{4}$ grain.

Potassii et sodii tartras, U. S. P. (tartrate of potash and soda, Rochelle salt), 1 to 8 drachms.

Pulvis effervescens compositus, U. S. P. (Seidlitz powder: soda bicarbonate, 40 grains, and sal Rochelle, 2 drachms, in blue paper; tartaric acid, 35 grains, in white paper), 1 to 2 powders.

Potassii ferrocyanidum, U. S. P. (ferrocyanide, or yellow prussiate, of potash), 10 to 30 grains.

Potassii hypophosphis, U. S. P. (hypophosphite of potash), 3 to 30 grains. (See PHOSPHORUS.)

Syrupus hypophosphitum, U. S. P. (syrup of the hypophosphites), 1 to 2 drachms. (See PHOSPHORUS.)

Syrupus hypophosphitum cum ferro, U. S. P. (syrup of the hypophosphites with iron), $\frac{1}{2}$ to 1 $\frac{1}{2}$ drachms. (See PHOSPHORUS.)

Potassii iodidum, U. S. P. (iodide of potash), 5 to 60 grains. (See IODINE.)

The best method of prescribing potassium iodide is: One ounce of the salt is dissolved in 5 $\frac{1}{2}$ drachms of hot water. The solution is then brought to 1 ounce with distilled water. This always results in a solution representing 1 grain in each minim, and, approximately, in each drop. Hyinson (Bulletin of Pharmacy; Med. News, May 13, '99).

Unguentum potassii iodidum, U. S. P. (iodide of potash, 12 per cent.). (See IODINE.)

Potassii nitras, U. S. P. (nitrate of potash, saltpeter, sal prunella), 10 to 30 grains.

Charta potassii nitratis, U. S. P. (paper

dipped in 20-per-cent. solution of nitrate of potash).

Potassii permanganas, U. S. P. (permanganate of potash), $\frac{1}{2}$ to 3 grains. (See MANGANESE.)

Potassii sulphas, U. S. P. (sulphate of potash), $\frac{1}{4}$ to 4 drachms.

Antimonii et potassii tartras, U. S. P. (tartar emetic), $\frac{1}{40}$ to 1 grain.

Ferri et potassii tartras, U. S. P. (tartrate of iron and potash), 10 to 30 grains. (See IRON.)

Liquor potassii arsenitis, U. S. P. (Fowler's solution of arsenic, 1 per cent.), 3 to 10 minims. (See ARSENIC.)

Poisoning by Potassium and its Salts.

—Potassium and its salts are rarely used for suicidal purposes. They are, however, extensively used in the arts, in the manufacture of glass and soap, under the name of potash and pearlash, and soap-lees, and in the form of concentrated lye for household purposes; sickness and occasionally death have occurred as the result of taking them accidentally.

POTASSA.—The symptoms of poisoning by potassa or lye are an acrid, nauseating taste, followed by a burning heat in the throat and stomach, severe abdominal pains, vomiting, and purging. Forty grains of caustic potash in solution have caused death. Death may take place within a few hours or days from laryngeal spasm or œdema, shock or cardiac paralysis, or it may be protracted several months (from inflammation of the stomach and intestines or stenotic disorders produced by cicatrization). (See ŒSOPHAGUS.)

The treatment for poisoning by caustic potash consists in the evacuation of the stomach and administration of a vegetable acid,—acetic, citric, or tartaric,—in the form of vinegar, cider, or lemon-juice, which neutralizes the alkali and forms neutral salts. The fixed oils, which

with potash form soap, should be given. Demulcent drinks will soothe the congested alimentary canal, digitalis and stimulants (hypodermically) will sustain the heart, and opium will alleviate the pain, control the purging, and lessen the inflammatory symptoms.

POTASSIUM BICHROMATE.—The bichromate of potash is also an irritant corrosive poison. The symptoms of poisoning by this substance are yellow stains about the body and clothes, restlessness, violent abdominal pain, vomiting, purging, and collapse. Death occurs from cardiac paralysis. The treatment consists in the evacuation of the stomach and bowels, the administration of chalk, soap-suds, and milk, or albumin, and the use of demulcent drinks and opium.

POTASSIUM BROMIDE.—This salt occasionally causes gastralgia when taken upon an empty stomach. This may be relieved by hot drinks and carminatives. (See BROMIDES.)

POTASSIUM CHLORATE.—In large doses chlorate of potassium exerts a paralyzing effect upon the spinal cord, but has a more profound action upon the blood, disintegrating the corpuscles and making it of a chocolate color. In poisonous doses vomiting with hæmatemesis, delirium, hæmatogenous jaundice, and coma result. The bodily temperature is markedly depressed, and rigors, cyanosis, and great muscular weakness are usually present. Death occurs from the depression of the vital powers, due to its destructive action upon the blood and the congestive obstruction of the kidneys.

In addition to the above symptom the appearance of small, punctiform, hæmorrhagic spots on the legs and extending to the trunk and upper extremities has been observed as late as the sixteenth day.

The use of potassium chlorate, even as a gargle, should be entirely given up

and forbidden. Even in small doses it is a severe blood poison, and may produce an hæmorrhagic nephritis. P. Jacob (Berl. klin. Woch., July 5, '97).

Treatment of Poisoning by Potassium Chlorate.—Two symptoms have been pointed out by F. Forchheimer as being a warning for the stoppage of this drug: drowsiness and a scantiness of suppression of the urine. Landerer advises, as the best treatment, venesection followed by infusions of normal salt solution, or, better, of defibrinated blood. In addition we may suggest, further, the use of saline purgatives and diuretics, especially caffeine and calomel, with hot baths.

On introducing potassium chlorate into the peritoneal cavity of rabbits, the animals died thirty-eight hours later in convulsion, especially of the respiratory muscles. This led to a study of the effects when the substance was injected into the brain. Opisthotonos was usually the first symptom. Tonic contractions soon gave way to clonic convulsions. With strong solutions, violent tetanic convulsions were produced. The experiments show the drug to be a strong poison for the nerve-cells, which are first excited, then paralyzed. On introducing it into the circulation it seems fair to assume that a certain amount reaches the brain in sufficient concentration to excite and paralyze, especially the respiratory centre. S. J. Meltzer (Ther. Gaz., July 15, 1900).

POTASSIUM CYANIDE.—The symptoms and treatment of poisoning by this drug are those of hydrocyanic-acid poisoning (see HYDROCYANIC ACID). The prompt administration of alkalies are advised to prevent the decomposition of this salt by the gastric juice. The stomach and intestinal canal should be evacuated as soon as possible and arterial stimulants (coffee, ammonia, caffeine) administered. Cold affusions to the spine and friction of the extremities are indicated. Death has occurred from 3 grains of this drug.

Morphine seems to be the antidote to the cyanide of potassium, and *vice versa*.

With regard to the mechanism of the neutralization of these two poisons, it is thought that, owing to the influence of the iron in the blood, which is an alkaline medium, there are formed Prussian blue and an oxide of morphine. Heim (Münch. med. Woch., No. 37, '96).

Acids should not be taken after the ingestion of potassium ferrocyanide, as it is decomposed even by weak acids, with the liberation of hydrocyanic acid.

POTASSIUM NITRATE.—In large doses this substance is an irritant poison. Death has occurred from one ounce. The poisonous symptoms are intense abdominal pain, vomiting, coldness of the extremities, diminished body-heat, partial paralysis, tremors, convulsions, and collapse. This drug has a paralyzing influence upon the spinal cord, which is evidenced by great muscular weakness and a reduction of reflex sensibility. Death usually occurs from cardiac paralysis or from collapse due to the irritant action of the drug upon the gastrointestinal mucous membrane.

There is no chemical or physiological antidote. The treatment of poisoning should begin with the evacuation of the stomach. Mucilaginous drinks may be given, and external warmth applied to the body. Cardiac stimulants (amyl-nitrite, caffeine, atropine) are needed to sustain the heart.

POTASSIUM SULPHATE AND TARTRATES.—These salts in large doses act as irritant poisons, producing severe abdominal pain, vomiting, etc. The treatment of poisoning by these salts consists in the evacuation of the stomach and the administration of warm demulcent drinks and opium. Cardiac stimulants may be needed, and warm external applications are usually indicated.

Therapeutics.

Caustics.—The caustic alkalies possess a very high diffusive power, and penetrate and destroy the tissues widely and deeply; so that certain precautions should be observed in their use lest the amount of tissue destroyed be larger than desired. When potassa is used as a caustic, the surrounding parts should be protected by adhesive plaster in one or more layers, a central hole having been cut out through which the caustic may have access to the skin. The size of the hole should be rather less than the area to be acted upon, as the eschar is apt to be larger than the area to which the caustic has been applied. The caustic in the form of the fused potassa is moistened slightly and rubbed firmly upon the surface till it assumes a dull-bluish look, and till the cuticle is softened and easily rubs off. The spot should then be washed with dilute vinegar, to neutralize any of the remaining alkali, and a poultice applied to facilitate the separation of the slough and to ease the pain.

Potassa alone is often more powerful than is desired, and it is commonly combined with quicklime, forming potassa cum calce, or Vienna paste, which must be moistened with alcohol before use.

Potash and Vienna paste have been extensively used to destroy cancerous growths, to limit sloughing ulcers, to remove the thickened, indurated edges of chronic ulcers, and to open boils, carbuncles, and indolent or deep-seated abscesses. They are said to prevent scarring. They have also been employed in the treatment of warts, *nævi*, malignant pustules, and phagedæna. Caustic potash has been used by surgeons in the post-operative treatment of fistula in ano, to keep the cut edges apart until the deeper parts of the wound are filled with granulations.

INGROWING TOE-NAIL may be treated successfully by painting the offending portion of nail with a solution of potash (25 per cent. to 40 per cent.). In a few seconds the upper layer of the nail will become soft enough that it can be easily scraped off with a piece of broken glass. This operation is repeated until only a thin scale of the nail remains, which may be excised with a pair of fine scissors.

FELONS.—Liquor potassæ has been used externally in the treatment of felons. The undiluted solution, painted on the felon every hour or two in its early stages, in many cases will abort it. Poultices containing a considerable quantity of unleached wood-ashes is used for the same purposes by the laity, with good results.

In a diluted form, liquor potassæ is used in cutaneous affections characterized by acid secretions and to remove crusts, etc.

Potassium bichromate, another member of this group, is used in saturated solutions for the removal of corns, warts, venereal vegetations, and mucous patches.

Potassium bichromate used with good results in treatment of warts, which are to be painted once a day with a saturated solution in boiling water. A certain amount of bichromate is precipitated when the solution cools, and this should be discarded and the liquid applied cool. Louvel-Dulongpré (*Treatment*, vol. i, No. 15, p. 356).

In a 1-per-cent. solution it is an astringent and deodorizer. This salt is used in the preparation of the battery-fluid used in zinc-and-carbon batteries, and is made as follows: 6 ounces of this salt are dissolved in 3 pints of water, and 6 fluidounces of commercial sulphuric acid are very slowly added to the solution. Müller's fluid, used for the preservation of anatomical and pathological speci-

mens, is composed of 3 parts of potassium bichromate, 1 part of sodium sulphate, and 100 parts of water.

Systemic Antacids.—The members of this group are used to neutralize an excess of acidity acting locally in the alimentary canal or through the blood upon systemic disorders due to or aggravated by the presence of undue acidity.

DISORDERS OF DIGESTION.—In acid dyspepsia associated with heartburn and pyrosis large doses of potassium bicarbonate (20 to 30 grains) will be found useful. In acid dyspepsia with pain or vertigo Robin advises the following: Potassium bitartrate, 3 drachms; sublimed sulphur, 1 $\frac{1}{4}$ drachms; precipitated chalk, $\frac{1}{2}$ drachm; Dover's powder, 15 grains; mix and divide into 10 powders, one to be taken after each meal.

In atonic dyspepsia small doses of the bicarbonate will stimulate the secretion of the gastric juice.

In some cases of gastralgia potassium bicarbonate in full doses given in some effervescent water will afford prompt relief.

The indigestion of obese persons, especially if they are rheumatic or gouty, will be relieved by full doses of bicarbonate given after meals, in full glass of water or, better, carbonic-acid water. The bicarbonate will not only prevent the formation of butyric acid, but will, moreover, also assist in emulsionizing the fats and in their absorption.

In acid diarrhoea potassium bicarbonate is an efficient remedy.

DISORDERS OF RESPIRATORY TRACT.—In bronchitis, especially in rheumatic and gouty persons, liquor potassæ is a good addition to the cough-mixture. J. V. Shoemaker gives the following: Liq. potassæ, 1 drachm; syrup of senega, 1 ounce; compound mixture of licorice, enough to make 6 ounces. Of this a des-

sertspoonful, in a wineglassful of water, is given every three hours when the expectoration is tough and scanty.

In pertussis potassium carbonate has been found valuable, given in doses of 1 or 2 grains several times a day.

GENITO-URINARY DISORDERS.—In gonorrhœa, as the urine is rendered alkaline under its use, liquor potassæ is frequently combined with other remedies, as in the following: Liq. potassæ, balsam of copaiba, of each, 6 drachms; mucilage of acacia, 3 ounces; spirit of nitrous ether, 6 drachms; tincture of opium, 1 drachm; water, enough to make 6 ounces; of this a tablespoonful, well diluted, is given three or four times a day in acute gonorrhœa.

In cystitis and pyelitis the same combination will be found serviceable. If in cystitis alkaline decomposition has set in, the use of alkaline remedies will aggravate the disorder by aiding the transformation of urea into ammonium carbonate. (Ringer.)

RHEUMATISM.—In acute rheumatism in plethoric persons with strong, acid perspiration, treatment with the alkalies gives most satisfactory results. If the system is alkalinized early in the disease, it is generally conceded that there is less danger of cardiac complications. The bicarbonate, citrate, acetate, or sal Rochelle may be given in doses of from 20 to 30 grains in cinnamon-water, well diluted, every three or four hours.

In chronic rheumatism iodide of potash, in 10-grain doses, given in compound syrup of sarsaparilla three times daily may be supplemented by alkaline baths made by dissolving 7 to 14 ounces of potassium bicarbonate in 30 gallons of hot water. The bath should be taken warm.

The alkalies are of great value in the uric-acid diathesis and in the various

cutaneous affections said to be dependent upon it.

Diuretics.—In œdema, ascites, and other serous effusions the diuretic effects of this group will be of great service. The acetate of potash may be given alone in doses of $\frac{1}{4}$ to 1 drachm, several times a day, or in a mixture similar to the following: Acetate of potash, 4 drachms; infusion of pilocarpus and compound spirit of juniper, of each, 2 ounces; of this a dessertspoonful, in a wineglassful of water, may be given every two hours in œdema with suppression of urine.

In functional inactivity of the liver the acetate of potash does good.

In lithæmia and in disorders of the urinary secretions the citrate or bitartrate may be used. A good combination is: bitartrate of potash (crystals), $\frac{1}{2}$ ounce; infusion of juniper, 1 pint; this amount to be taken in divided doses during the twenty-four hours.

In chronic Bright's disease the bitartrate and acetate are valuable; also in puerperal eclampsia.

In œdema of heart disease the bitartrate or acetate may be used in the form of the "Potus Imperialis": cream of tartar, $\frac{1}{2}$ ounce; water, 3 pints; sweeten and flavor with orange-peel.

The members of this group are useful in the treatment of uric-acid calculi. The best, perhaps, is the citrate, as it has the least tendency to derange the stomach when taken over a long period of time. We may give 5 grains each of the citrates of potash and lithia in Vichy water every four hours, as it is necessary in these cases to keep the urine continuously alkaline.

The citrate of potash is a valuable remedy in those cases of incontinence of urine which are due to a too-concentrated condition of the urine.

Purgatives.—The purgative salts of

potash belong to that class of purgatives generally known as saline cathartics. Their activity depends upon their power to increase intestinal secretion. Experiment has shown that the strength of the solution of a saline cathartic as it exists in the intestines within two hours after the administration of the salt is 5 or 6 per cent. If the salt has been given in greater dilution than this, water has been absorbed from it until this strength has been reached; if in greater concentration, the tissues have yielded their fluids to dilute it to the necessary degree. It then follows that if we wish to produce serous depletion, we should administer the salines in concentration; on the other hand, if we desire prompt action, they should be given in a solution of about 5-per-cent. strength. It is also a well-known fact that, if for any reason the saline fails to produce purgation, absorption of the salt takes place and a marked diuretic effect will follow. This explains why the members of this group are classed with the diuretics when they are administered in small doses.

The members of this group are useful in acute inflammations on account of their antiphlogistic action. In congestive and dropsical conditions and ascites the salines given in concentrated solution are hydragogues. In abdominal inflammations, as appendicitis and chronic peritonitis, they are antiphlogistic and depletive. In acute peritonitis they are useful in cases following surgical operations, but are contra-indicated by feebleness and by perforation or obstruction of the bowels.

In serous effusions, as pleurisy, the salines are given in the second stage to remove the effusion, and should be administered in concentrated solution. In abdominal hæmorrhage they are useful as hæmostatics, when given in concen-

trated solution, since by depletion they lower the blood-pressures. In hæmorrhages due to hepatic obstruction they are particularly beneficial because of the depletive action on the portal circulation.

In plethora, if constipation is present, as it usually is, the daily use of salines before breakfast is to be recommended. Persons suffering from uric-acid diathesis with rheumatism or gout should use the salines by choice when laxatives or purgatives are needed, as they aid elimination and are antacid. A useful laxative where hæmorrhoids are present is the following: Cream of tartar, 1 ounce; washed sulphur, aromatic powder, of each, $\frac{1}{2}$ ounce; one teaspoonful of this may be made into a bolus with orange-syrup, and taken once or twice a day. In alcoholic cirrhosis cream of tartar in dose of $\frac{1}{2}$ to 1 ounce is an excellent hydragogic purgative. As an aperient, cream of tartar may be given in doses of from 1 to 2 drachms.

Sal Rochelle, or the tartrate of potash and soda, is an ideal saline laxative. It is most efficient when taken in the early morning when the stomach is empty; this is true of all salines. Sal Rochelle is the laxative agent in the Sedlitz powder, of which one is laxative and two are purgative.

The sulphate is a gentle cathartic, causing little pain, producing watery stools, and having some cholagogic action; it is said to act beneficially when suppression of the milk is desired, and is often given in fevers and after delivery as a laxative in doses of from 1 to 2 drachms. The acetate of potash may be given as a purgative in doses of from $\frac{1}{2}$ to 2 ounces.

Febrifuges.—The members of this group are useful in fevers and inflammations in that they lessen heat and promote excretion of the inflammatory products.

The febrifugal salts of potash lessen the blood-pressure, the temperature, and the heart's action.

In the mild fevers, as measles and scarlet fever, the solution of the citrate of potash may be given in doses of 1 to 4 drachms every two hours. If preferred, an extemporaneous solution may be prepared as follows: Carbonate of potash (15 grains) is dissolved in $\frac{1}{2}$ ounce (tablespoonful) of water, and this solution added to 1 ounce (2 tablespoonfuls) of a mixture of equal parts of lemon-juice and water; this is given in a single dose, and should be freshly prepared each time. For convenience, a solution of the carbonate may be made up in quantity, each $\frac{1}{2}$ ounce of which contains 15 grains of the salt.

In acute rheumatism the nitrate of potash may be used as a febrifuge, 1 ounce of the salt being dissolved in 1 pint of barley-water or in the same quantity of syrup of gum arabic and water; a tablespoonful may be taken every three hours.

DISORDERS OF THE RESPIRATORY TRACT.—In pneumonia, nitrate of potash may be given, with great benefit, in small doses ($\frac{1}{4}$ grain), combined with $\frac{1}{12}$ to $\frac{1}{6}$ grain of Dover's powder every two or three hours.

In asthma relief is generally obtained by igniting small squares of bibulous paper previously dipped in a 20-per-cent. solution of nitrate of potash and dried (*charta potassii nitratis*), and inhaling the fumes.

The hoarseness of singers and speakers is relieved by 2 grains of the nitrate dissolved in a glass of sweetened water.

MALARIA.—In malarial intermittent fever the nitrate is especially valuable, if given in a single dose of from 15 to 24 grains in either the febrile or the non-febrile stage.

The nitrate is a reliable remedy in hæmoptysis with fever.

PURPURA.—In purpura simplex 10-grain doses of the nitrate are useful; in purpura hæmorrhagica it may be given in doses of from 10 to 60 grains.

BURNS.—In the treatment of burns of all kinds potassium nitrate has been strongly recommended by Poggi (Rev. Méd., Feb. 16, '96) as a topical application. (See BURNS.)

Alkaline Lotions.—Alkaline lotions are used with benefit in cutaneous and other disorders. A weak solution of the bicarbonate (1 drachm to 1 pint) has been used as an application to rheumatic joints, and in eczema in the early and middle stages when there is a copious weeping from a red and raw surface. Hebra advises the application of liquor potassæ or of a stronger solution of potash in the chronic forms of eczema. He brushes liquor potassæ, once a day, over the surface, and, if it produce much smarting, washes the residue off with cold water. When the skin is only slightly infiltrated and thickened he employs a solution of 2 grains of caustic potash to 1 ounce of water; but, if the infiltration is greater, he uses a solution containing from 5 to 30 grains or more to the ounce. These stronger applications must be employed only once a day and must be quickly washed off with cold water. This treatment speedily allays the itching, but is apt to make the skin brittle. To obviate this condition McCall Anderson applies, every night, either codliver-oil or glycerin. Anderson frequently employs alkalis in conjunction with tar or oil of cade, as in the following: Equal parts of soft soap, rectified spirit, and oil of cade; a little of this to be firmly rubbed over the eruption night and morning; it should be washed off before each reapplication.

SKIN DISEASES.—In eczema of the vulva Lusch advises the use of the following: Bicarbonate of potash, 1 drachm; bicarbonate of soda, 2 drachms; glycerin, 1 1/2 drachms; laudanum, 2 drachms; water, 8 ounces; this is to be used as a lotion, night and morning.

In pruritus vulvæ, and in bites and stings, a solution of the bicarbonate (2 drachms to 1 pint of water) will give relief.

A weak solution of caustic potash or of the carbonate (1 drachm to 1 pint), applied with a small piece of sponge, is often of extreme comfort in urticaria or lichen. A solution of the same strength of the cyanide of potash, which has a strong alkaline reaction is, perhaps, better. (Ringer.)

GENITO-URINARY DISEASE.—In functional leucorrhœa, due to excessive secretion of the glands of the cervix uteri, the vaginal injection of a weak solution of the bicarbonate (1 drachm to 1 pint) will give relief; when the discharge is like the white of an egg or lumpy, three or four injections will often cure; but, when the discharge is yellow and puriform, these injections may fail, although, in many cases, when this yellow discharge is due to a mere abrasion of the os uteri, these injections, continued for a week or two, will change the yellow to a white discharge. (Ringer.)

Anti-emetics.—The citrate of potash is often serviceable as an anti-emetic in doses of from 1/2 drachm to 4 drachms; the official liquor potassii citratis is often preferred in doses of from 1 to 8 drachms.

In the nausea and vomiting of the first stage of acute bronchitis and of febrile affections in general the use of the citrate in the form of "neutral mixture" (liquor potassii citratis) or effervescent draught will allay the trouble. Effervescent draught is composed of two solutions: a

solution of bicarbonate of potash ($2\frac{2}{3}$ ounces to 1 pint) and a solution of citric acid (2 ounces to 1 pint), the dose being $\frac{1}{2}$ to 1 ounce of each solution, mixed when needed.

Potassium Chlorate.—Potassium chlorate is different from all the other salts of potassium, not only in its physiological action, but in its therapeutic effects. It is, perhaps, the most poisonous, with the exception of the cyanide. When locally applied to the mucous membranes its action is that of an irritant, and when absorbed into the blood it causes destructive changes in it (methæmoglobinæmia), and, if given in overdose, induces acute nephritis. It was formerly thought that chlorate of potash when taken into the system was decomposed and yielded a large amount of oxygen, but later experiments have shown that it passes from the body unchanged. It should never be triturated with sulphur, tannin, charcoal, or glycerin, as explosion is apt to follow.

STOMATITIS.—Chlorate of potash in solution (1 to 16) is used as a detergent mouth-wash and especially in mercurial salivation. The following solution is recommended for the latter use by Hare: Chlorate of potash, 48 grains; tincture of myrrh, $\frac{1}{2}$ drachm; elixir of calisaya, 3 ounces; of this mixture a teaspoonful may be taken every five hours, and may be used as a mouth-wash. In membranous or ulcerative sore mouth, in children, the same mixture or the plain solution (1 to 16) may be employed in smaller dose. In aphthæ the chlorate, finely powdered, alone or with powdered sugar, may be dusted on the patches. Dillon's antiseptic dentifrice contains chlorate of potash: Salol, chalk, charcoal, and powdered cinchona-bark, of each, $2\frac{1}{2}$ drachms; chlorate of potash, 1 ounce.

DISORDERS OF THE RESPIRATORY TRACT.—In diphtheritic and scarlatinal sore throat the chlorate in solution (1 to 16) may be applied with a swab or used as a gargle, but is not to be swallowed.

In diphtheria Waugh commends the following: Chlorate of potash, 1 drachm; hydrochloric acid, $1\frac{1}{2}$ drachms; mix and add tincture of the chloride of iron, 2 drachms; water, a sufficient quantity to make 4 ounces; of this a teaspoonful undiluted is given every two hours. When diluted with equal parts of water it makes an excellent gargle. Free chlorine is generated in this mixture.

In anginose sore throat H. C. Wood commends the following: Sumach-berries, 1 ounce; chlorate of potash, $\frac{1}{2}$ ounce; boiling water, 1 pint; allow to simmer for a few hours, then strain, cool, and use as a gargle several times during the day. The official troches may be used, allowing the troche to dissolve slowly on the tongue, but not too freely, lest poisonous symptoms should develop.

Chlorate of potassium should not be administered on an empty stomach, and the urine should be examined for methæmoglobin, which should guide the amount of salt ingested. Wohlgemuth (Med. Press and Circ., July 8, '91).

GENITO-URINARY DISEASES.—In inflammation of the bladder and rectum this drug has been used in solution as an injection. In acute rectal catarrh with mucous diarrhœa and tenesmus H. C. Wood advises the use of a solution (20 grains to 1 ounce) of chlorate of potash by rectal injection; not more than 4 ounces of the solution should be used at one time and that should be retained for twenty minutes. A cure will often result after one or two injections. In some cases it is well to add a saturated solution of the chlorate to an equal quantity of starch-water, as the latter aids in allaying the irritation. This is also useful in

hæmorrhoids, especially if a few drops of laudanum are added (Hare).

SKIN DISEASES.—The irritant action of the chlorate upon mucous membranes was utilized by P. D. Keyser in the treatment of epithelioma of the eyelid, who suggested daily applications of finely-powdered chlorate to the tumors, in many cases obviating the use of the knife.

Dumontpallier (*Presse Méd.*, Mar. 18, '96) has used the chlorate in three cases of tumors of the gums and of the tongue. One patient had been operated on for epithelioma of the tongue and during convalescence a recurrent nodule appeared near the cicatrix. Applications of lunar caustic were made, but the nodule increased in size until in dimension and shape it resembled a large bean and was papillomatous in appearance. Local applications of the chlorate, in powder, were made six times daily, and $6\frac{2}{3}$ grains were given internally every four hours. In six weeks it was one-half the original size; three weeks later two small painless protuberances were visible, and two months later the growth had entirely disappeared. Continuance of treatment for two or three months is advised, and absolute assurance of the functional activity of the kidneys is necessary. The condition of the teeth, as a cause of irritation, should be ascertained.

The chlorate of potassium has been employed with more or less success in cutaneous disorders attended with supuration. It has been found beneficial in the suppurative stage of sycosis, in pustular acne, in eczema pustulosa, and in the treatment of furuncles and carbuncles. Externally the chlorate has been found useful in powder or in saturated solution, as an application to unhealthy ulcers.

POTASSIUM CYANIDE.—Potassium cyanide has been used externally in solu-

tion (1 drachm to 1 pint) to allay paræsthesia, and as an application to the head to relieve reflex headache.

It is used internally ($\frac{1}{16}$ to $\frac{1}{4}$ grain) in mixtures to relieve cough, the effect being similar to that of hydrocyanic acid.

In nervous dyspepsia J. P. C. Griffith combines cyanide of potash with extract of valerian, given after each meal.

POTASSIUM AURO-CYANIDE.—Potassium auro-cyanide occurs in white crystals which are soluble in water. When injected hypodermically it is rapidly absorbed and does not precipitate albumin.

Behring's researches have shown that 1 part of this salt in 25,000 parts of blood-serum rendered the latter unsuitable as a medium for the growth of the anthrax bacillus.

POTASSIUM MERCURO-CYANIDE.—The allied mercurio-cyanide effects the same in a dilution of 1 to 60,000.

POTASSIUM CANTHARIDATE.—This substance occurs as a white, amorphous powder or in crystalline mass which is soluble in water. It has been used by Liebreich hypodermically in very attenuated solutions in the treatment of tuberculosis.

POTASSIUM COBALTO-NITRITE.—This salt occurs in yellow, microscopical crystals, which are slightly soluble in cold water and insoluble in alcohol and ether. It is used where the nitrites are indicated (dyspepsia, cardiac albuminuria, etc.), and is claimed to be more easily regulated in its physiological action than most nitrites. It is given in doses of $\frac{1}{2}$ grain, every two to four hours.

POTASSIUM DITHIOCARBONATE.—This salt results from the action of carbon disulphide on potash-lye at boiling temperature. It occurs in an orange-red, deliquescent crystalline powder, which is very soluble in water, and slightly soluble in alcohol. It is used in a 5- to 10-

per-cent. ointment in the treatment of eczema, tinea tonsurans, and other cutaneous disorders. In a 20-per-cent. ointment it is used in psoriasis.

POTASSIUM OSMATE.—Potassium osmate, or perosmate, occurs in a violet-red crystalline powder, soluble in water. It is used in the dose of $\frac{1}{60}$ to $\frac{1}{4}$ grain in combination with the bromides against epilepsy, and hypodermically in neuralgia, goitre, etc., like perosmic acid.

POTASSIUM SOZOIODOLATE.—Potassium soziodolate (or potassium di-iodo-para-phenol-sulphonate) occurs as a glittering, white crystalline, powder, having a slightly-sour taste, soluble in hot water, and slightly soluble in cold water (1 to 70). It contains 52.8 per cent. iodine, 20 per cent. phenol, and 7 per cent. sulphur. It is antiseptic and bactericidal in its action. It is incompatible with mineral acids, ferric chloride, silver salts, etc. Strong sulphuric acid or heat drives off iodine-vapor. It is a substitute for iodoform. It is non-toxic, odorless, and soluble. Even when applied pure it does not irritate the skin; when the skin is inflamed it leads to a mild and reactionless exfoliation. It acts as a desiccant in powder or salve in concentration of from 1 to 10 to pure.

It is used externally in scabies, eczema, erysipelas, herpes tonsurans, impetigo, syphilitic ulcers, diphtheria, burns and scalds, ozæna, otitis and rhinitis, and as an injection for gonorrhœa. A $2\frac{1}{2}$ -per-cent. solution is sufficiently strong to kill *Acarus scabiei* in twenty-five minutes.

POTASSIUM TELLURATE.—This salt occurs in white crystals, soluble in water. It was introduced by Neusser and is used in doses of $\frac{1}{2}$ to $\frac{3}{4}$ grain in pill or alcoholic julep in the treatment of the night-sweats of phthisis. After one week it may be necessary to double the dose. No

toxic symptoms follow its use. The appetite improves. During its administration the breath has a garlicky odor. This salt suppresses or diminishes the sweats, but does not influence the course of the disease.

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POTT'S DISEASE. See SPINE.

PREGNANCY, DISORDERS OF. (See also ABORTION.)

General Etiology.—Although pregnancy is a normal physiological condition and as such should be subject to no disorders except such as are purely accidental, it is but a truism to state that the variations from the normal are, in fact, most numerous and diverse. Penalties are these, for the most part, for the privilege of being civilized. Those who live in a state of Nature, as the wild animals live, are not, it is true, exempt from all disorders during the pregnant state; but the number of those who suffer is relatively smaller, and their sensitiveness to suffering is far less acute than is the case with women in civilized communities. Serious and even fatal disorders are of occasional occurrence among the savage and uncivilized, and they may also occur among animals.

The causes of disturbance during the pregnant state may be inherent in the individual at the inception of pregnancy, they may be due to pregnancy, or they may be the result of pregnancy *plus* other causes to which the individual may have contributed or which may be regarded in the light of accidents.

The following classification is submitted:—

I. Causes which are present when pregnancy is instituted:—

1. Faults of structure:—

- (a) Structurally-defective pelvis.
- (b) Defective uterus.
- (c) Tumors in various parts of the body, especially in the pelvis or abdomen.

2. Faults of nutrition.

- (a) Badly-nourished uterus.
- (b) Local disease in any organ, or any disease which seriously modifies the general condition.

II. Causes which are due to pregnancy, the patient being apparently in normal condition at its inception.

1. Mechanical influences:—

- (a) Pressure of the enlarged or displaced uterus upon contiguous structures.

(b) Disturbed circulation either from immediate pressure upon vascular structures or arrests of the current in its ordinary channel.

(c) Pressure upon the uterus by a new growth which has developed coincidentally with pregnancy.

2. Nervous reflexes, usually irritative in character.

3. Nutritive changes especially in the blood, nervous system, digestive apparatus, or secretions.

III. Causes which are due to pregnancy *plus* additional provocation from within or without the individual:—

- 1. Improper diet or habits.
- 2. Trauma.
- 3. Nervous and mental irritants.
- 4. Intercurrent disease.
- 5. Irritating conditions within the ovum.

I. CAUSES WHICH ARE PRESENT WHEN PREGNANCY IS INSTITUTED.—Of the causes of disorder in pregnancy which are present at the inception of the pregnant state there are, as before stated,

1. *Faults of Structure.*—(a) Structurally-defective pelvis. This may consist in the various deformities—pelvis too large, pelvis too small, or pelvis of

irregular contour—which interfere with the proper and symmetrical development and enlargement of the uterus and the ovum which it contains.

This interference in the development of the uterus may lead to abortion; may produce pain, nausea, and vomiting; faults of digestion, constipation, interference with the pelvic circulation, and a variety of distressing phenomena during pregnancy, as well as difficulty during parturition. The pelvis may also be the seat of serious disease (*e.g.*, osteomalacia), weakening its structure and rendering it unfit as a support for the body and incidentally for the pregnant uterus.

(b) Defective uterus. This may consist in a faulty position or in imperfections of structure which may properly be attributed to bad nutrition. The displaced uterus—whether the displacement be anterior, lateral, or posterior—is certainly a defective uterus for any purpose and in any situation, and it becomes the more strikingly so when it has been impregnated. Normal development is hindered, the circulation becomes impaired, pain and discomfort give annoyance, and unless the displacement is corrected uterine contractions may be provoked and the contents of the uterus expelled. Correction may be and often is spontaneous, but is not always a result, especially if the displacement is a posterior one. The diagnosis is almost always susceptible of determination by means of a careful bimanual examination, and successful treatment is usually possible unless the uterus is fixed by adhesions in its faulty position.

(c) Tumors in various parts of the body, especially in the pelvis or abdomen. A tumor in any part of the body, especially if of a malignant character, may so impair the general condition as

to militate against the successful continuance of pregnancy. This is notably the case, in addition to malignant disease, with the tumors which develop in connection with tuberculosis, syphilis, and other constitutional diseases. With the tumors of the pelvis and abdomen, whatever their character, it is easy to see that, by their very presence, by their encroachment upon the space required by the uterus as it enlarges, they may be an efficient cause of pain, of disturbance in the circulation, of digestive disorders, etc., and if they do not compel the uterus to throw off its contents they may so complicate the situation that parturition will become not only difficult, but positively dangerous. Indeed, successful delivery by the ordinary method and measures may be quite impossible, and removal of the tumor may be required before the uterine contents can be removed.

2. *Faults of Nutrition.* — (a) Badly-nourished uterus. The uterus which thus becomes a source of disturbance during pregnancy may be congenitally defective, or its defects may be the result of disease, bad habits, or traumatism. The entire organ may be rudimentary and poorly developed, or the difficulty may be limited to the muscular structure or to the endometrium. Arrest of development during foetal life from causes which are not always traceable is not particularly rare. Arrest of development from the diseases common to childhood or from constitutional disease (syphilis, tuberculosis, etc.) is also not infrequent. Traumatism, as from rape, from the forcible thrusting of sticks or other hard substances into the vagina, from burns, and from caustic substances is of less frequent occurrence.

In any of these cases pregnancy comes to an organ ill prepared to perform its function, and it does not respond to the

demands which are made upon it. We should not be surprised that pain and discomfort accompany such a pregnancy, and that its termination should be an abortion in the early months.

Another class of cases is that in which the uterus is defective from growths within its structure, especially fibroid growths. Whether these are located within the muscular structure, upon the peritoneum, or within the uterine canal, they are always a menace to pregnancy, and frequently are an efficient cause in producing its premature termination. While the disorders which attend this class of cases consist principally in disturbance which affects chiefly the uterus itself and its immediate surroundings, it not infrequently happens that systemic infection is added, and the final result may be a disastrous one for the patient.

The impaction of the uterus with fibroids secondary to conception is not only responsible for pain,—and in a certain proportion of cases to retention of urine from direct pressure on the urethra,—but it probably accounts for the frequency with which abortion occurs under these conditions, and it is interesting to observe how even a relatively small fibroid will impede the ascension of the uterus as it enlarges during pregnancy and give rise to much trouble. The tumor may likewise obstruct delivery when the pregnancy grows to full term. Septic endometritis is rendered more serious when the infected uterus contains fibroids. Necrosis and consequent gangrene of the fibroid arises usually from injury, and may even result from the efforts of the uterus itself to expel the pedunculated tumor. It does not necessarily follow that in every parturient woman with a fibroid the tumor becomes septic. In cases complicated by tumor which have reached term, if the growth cannot be pushed out of the pelvis, Cæsarean section should be

performed. Bland-Sutton (*Lancet*, Feb. 16, 1901).

The form of surgical interference, always indicated when any surgical procedure is warranted at all, is myomectomy. Statistics before 1890 are of little value. Between 1890 and 1900 the reported cases of myomectomy in pregnancy amount to 44, the maternal mortality being 9 per cent.; the foetal, 21 per cent. Since January 1, 1900, to April, 1901, 5 cases of myomectomy in pregnancy have been reported (Dolérís, Lewis, Muir Evans, Gemmel, and Emmet's present case). In 3 delivery occurred at term. Green (*Jour. Amer. Med. Assoc.*, Mar. 16, 1901).

(b) Local disease in any organ, or any disease which seriously modifies the general condition. Aside from disease in the uterus itself antedating pregnancy, there may be disease in the tubes or ovaries or both which may give rise to much trouble. Simple inflammatory conditions of these organs or distinctly-infectious disease, acute or subacute, may excite much discomfort and perhaps lead to serious results.

Case which seemed to show that there is a close association between eclampsia of pregnancy and certain affections of the thyroid body. The patient was six and a-half months pregnant; she had noticed that her neck had been swelling for some time; its circumference was $11\frac{1}{4}$ inches above and $12\frac{3}{4}$ inches below. There was no exophthalmos or œdema, but there was a trace of albumin in the urine, which contained 3.66 grammes of sugar to the litre. Under a diet of milk and meat the glycosuria vanished, but on its discontinuance sugar reappeared and continued for three weeks, until delivery. At that date the circumference of the neck was still $11\frac{1}{4}$ inches above, but nearly $14\frac{1}{2}$ below. A fortnight after delivery sugar had disappeared from the urine, the neck showed slight reduction in circumference below (14 inches); two months later the measurement was $12\frac{3}{4}$ inches, as when the patient was first examined. The glycosuria—a disturb-

ance of nutrition which in Bar's opinion is akin to albuminuria—was possibly caused by changes in the thyroid. Bar (*L'Obstetrique*, Mar., 1904).

Disease of the liver, kidneys, heart, or lungs may antedate pregnancy and may suffer exacerbation as pregnancy advances.

The disturbance may be sufficient to provoke abortion or the patient may go to term in spite of the concurrent disease. Death during parturition is not uncommon with those who suffer with such disease. In other cases the patients recover a moderate degree of health after a prolonged and severe puerperium.

Twenty cases of pregnancy complicated by cardiac disease noted and following conclusions reached: Women with heart disease conceive as often and as easily as healthy women, but gestation is more apt to end in abortion. Pregnancy generally aggravates the cardiac trouble, either temporarily or permanently, and under certain circumstances is attended with great danger. The causes which may determine death are pulmonary œdema and syncope by arrest of the heart's action, sometimes immediately after labor and sometimes several weeks later. The physician should, therefore, oppose the marriage of women suffering from heart disease, and advise abstinence in those already married. When serious cardiac symptoms arise in the course of gestation, which cannot be controlled by ordinary measures, the pregnancy should be arrested by artificial means. This indication is especially urgent when there is dyspnœa, œdema, or weakness of the heart. The results of induced abortion in such cases are more satisfactory than formerly. Chloroform may be used if the degree of prostration is not too pronounced. These conclusions are also applicable to cases of pulmonary tuberculosis, which is always aggravated by pregnancy. Leyden (*Zeit. f. klin. Med.*, Nos. 1 and 2, '93).

Expectation of life in children born of women with serious heart-lesions is much

impaired; so that too much consideration for the life of the child, without benefit to either, probably has been given.

Of 7 cases of women collectively pregnant 31 times. Of the 15 children born before the cardiac symptoms became so severe as to require advice, 12 are alive and 3 are dead. In the 16 other pregnancies, in which the cardiac symptoms were marked, all but 3 are dead and 1 of the 3 surviving has but a few months to live. George Sears (*Amer. Medico-Surg. Bull.*, Apr. 15, '95).

In pregnancy with cardiac disease sole thought should not be given to heart; by watching and treating the kidneys, the skin, the intestines and the lungs, the state of the heart may be relieved, asphyxia and intoxication be prevented, and time gained. Artificial labor is rarely indicated in a pregnant woman in whom the cardiac symptoms have ended or are about to end in asystole. Venesection acts more favorably and rapidly, aided by oxygen to stimulate the lungs, milk for the kidneys, purgatives, and intestinal disinfectants. Rivière (*Gaz. Hebdom. des Sci. Méd. de Bordeaux*, June 30, '95).

Influence of pregnancy on 62 women who were the subjects of mitral stenosis. Of these 23 died, either in the course of pregnancy, in parturition, or within three weeks after delivery. The most fatal period for such women is just after delivery; 14 of the 23 died between sixteen and twenty-two days after the birth of the child, 2 died in labor, and 7 before parturition set in. Abortion or premature labor was not infrequent.

Hæmorrhages from the lungs and uterus are pretty common, but are to be regarded in a favorable light, for they occurred in only 8 of the 23 fatal cases, whereas they happened in 18 of the cases that ran a favorable course. Anasarca, albuminuria, and convulsions are not constant. H. B. Allyn (*Glasgow Med. Jour.*, Oct., '95).

To relieve symptoms of the disturbed heart's action in pregnancy every exertion must be interdicted, and the patient should remain in the recumbent posture the greater part of the day. Frequent examination of the urine is in-

dispensable. A strict milk diet must follow the finding of the first trace of albumin. Cardiac stimulants are indicated. If this mode of treatment is not followed by an amelioration of symptoms and the cardiac incompetency increases in spite of efforts, question of the propriety of terminating pregnancy may justly arise. Success can only be expected if the pregnancy is terminated *before* the onset of serious symptoms. Julius Rosenberg (*N. Y. Med. Jour.*, Jan. 18, '96).

Conclusions regarding heart in relation to pregnancy, parturition, and puerperal state: 1. Fact of hypertrophy of the left ventricle occurring in normal pregnancy should be accepted as proved. In delicate and feebly-developed subjects it may sometimes be absent, and in these cases signs and symptoms of cardiac insufficiency are likely to occur. 2. A certain amount of dilatation of all the chambers of the heart does normally occur in pregnancy. 3. Failure of the ventricle has a distinct effect upon the course of pregnancy. In the early months it leads to abortion, and in the later months to premature delivery. 4. The heart during pregnancy and the puerperium is specially liable to undergo fatty degeneration. 5. The condition of the muscular heart-wall is of more importance during pregnancy than the valvular lesion; many women with valvular lesions pass through their early pregnancies without any sign of heart-failure, but as the heart-muscles become deteriorated by the strain of repeated pregnancies they show increasing evidence of cardiac insufficiency. 6. Of all the forms of valvular lesion, mitral stenosis of a marked degree is the most disastrous. M. Handfield-Jones (*Lancet*, Feb. 1, '96).

It is necessary to interrupt pregnancy in cases of heart disease only in those patients in whom there is a disturbance of compensation. In all other instances satisfactory results will follow close care during the latter months of pregnancy and labor, as well as in the puerperium. If heart disease be discovered during gestation a milk diet, constant rest before and after labor, and heart-tonics will

generally suffice. In mitral disease heart-failure is most apt to occur during the second stage of labor. In aortic disease the most dangerous period is immediately after labor. Luoff (*Annales de Gynéc.*, Dec., '97).

There are four indications for prophylaxis in regard to the kidney in pregnancy: 1. The urine of all pregnant women should be regularly examined especially after the sixth month. Examination of the urine should be chemically for albumin, sugar, and total solids, and microscopically for casts. It is of the most importance to obtain an approximate idea, at least, regarding the amount of urea excreted in twenty-four hours. 2. The formation of toxins is best prevented by careful regulation of diet and by an abundance of pure air. Pregnant women should not eat too much meat, and that only once a day. Lamb, mutton, fish, and oysters are best for them, with raw or cooked fruit, and with the lighter fresh vegetables in moderation. Graham or whole wheat bread and all cereals are also helpful. Spirits should be interdicted during pregnancy. 3. The gravid uterus makes quite enough pressure upon the kidney without the added weight of heavy skirts, tight bands, and a laced-in corset. The clothing should be light and suspended from the shoulders. All of the limbs should be protected by flannel undergarments, except in the hottest weather. Multiparæ are often helped by a bandage. 4. To promote excretion by the skin, frequent baths are necessary. A proper evacuation of the bowels is the most important duty that the future mother has to perform. *Cascara sagrada*, either as fluid extract or as the aromatic trade preparation, daily doses of compound-licorice powder, sulphur and cream of tartar, saline mineral waters, small doses of colocynth and podophyllum are all useful. A glass of milk in the morning purges some patients, though it constipates others. If there be beginning signs of renal incompetence, saline diuretics, spiritus ætheris co., infusion of digitalis, if the arterial tension be not too high, will be found useful in increasing kidney secretion. Large quantities

of fluid—such as alkaline mineral waters, milk, bitter vegetable infusions, or even of ordinary water—will prove of service. Mercuric chloride—to increase the flow of urine, to diminish the œdema, and to improve nutrition—should be given for a long time in doses of at least $\frac{1}{40}$ grain three times a day.

In this manner 80 per cent. of the patients who are in danger from renal failure and faulty metabolism may be tided over until they are safely delivered. James L. Kortright (*Brooklyn Med. Jour.*, Apr., '99).

A woman having a heart lesion which is compensated should not be prevented from marrying. Abortion should not be induced on a woman with heart disease unless very serious symptoms are present. Premature labor should seldom or never be induced on account of heart disease. Mitral stenosis is the most serious heart lesion during pregnancy and labor; aortic stenosis comes next; then, probably, aortic incompetency. Mitral insufficiency is the least serious lesion. A. H. Wright (*Amer. Med. Quarterly*, Sept., '99).

Where true nephritis exists before or begins in pregnancy, the disease, as a rule, is a more serious matter than in the non-pregnant state, and the prognosis is unfavorable. In the case of chronic nephritis, an acute exacerbation is usually induced. The patient may die from kidney-failure, and uræmia is very apt to occur. Only in a small percentage of cases are the phenomena of eclampsia noted, as has been pointed out by Fehling and Leyfert.

As regards the influence on the course of pregnancy, the tendency to premature emptying of the uterus is to be particularly noted. According to P. Müller, it occurs in more than 40 per cent. of cases. It is attributed to various causes, viz.: hæmorrhages into the placenta, causing infarcts and destruction of portions of the chorionic villi, or separation of the placenta. The foetus may die as a result of the accumulation of toxic material in the system, and this is an important cause of the premature expulsion. The foetal mortality is very high. Hofmeier noted that the foetus died in twenty out

of twenty-three cases of nephritis. Braun has estimated the mortality at 80 per cent. J. C. Webster (Jour. Amer. Med. Assoc., Apr. 21, 1900).

Notes of 13 cases in which cardiac disease has complicated labor. Among these there are 3 cases of aortic stenosis, 1 of which terminated in premature labor and 2 in labor at full term. The mother made a full recovery and 2 of the children lived. The remaining cases were those of mitral disease, in which the degree of incompetency varied, as did also the condition of the heart-muscle. In some of the cases mitral stenosis was present, and 2 cases were complicated by tricuspid incompetence as well. Most of these patients went to full term. There was 1 death from cardiac failure. One patient had high fever, which fell after the bowels had been thoroughly moved, the patient discharging a large quantity of very offensive fæces. Another patient after labor was seized by a rapidly increasing and most threatening anæmia, from which she made a very gradual recovery. Jardine (Jour. of Obstet. of the British Empire, April, 1902).

Constitutional disease at the inception of pregnancy may also be a very troublesome disturbance to that condition. This may consist in syphilis, tuberculosis, profound anæmia, or any wasting or intensely infectious disease which in itself is a severe drain upon the vital forces. Pregnancy is often interrupted under such conditions.

If it should continue to term the child may be dead at birth or so poorly nourished that death may occur without a very prolonged struggle.

Artificial abortion is only indicated when there is endocarditis with œdematous swelling, well-advanced tuberculosis, nephritis, uterine disease, deformed pelvis which would necessitate Cæsarean section, or uncontrollable vomiting. After the necessity for artificial abortion has been established, the operation should be resorted to at the earliest possible moment to protect the patient.

The attending physician should always call in consultation some colleague. The following technique has never failed nor has ever caused untoward results: A metallic curved catheter, with a lumen of about 2 millimetres, is introduced into the uterus as far as the fundus. This is absolutely imperative, for it brings the instrument in the immediate neighborhood of the embryo. About a drachm of tincture of iodine is injected through the catheter. The vagina is tamponed to prevent the iodine, which may partly trickle down, from irritating the vaginal mucosa. About three days thereafter a little blood is passed, and the abortion results in the nature of an ordinary menstruation. This may not occur if the catheter has not reached the fundus. In that case the operation is again performed. The entire procedure is so little exciting to the patient that she may go about immediately and need not necessarily go to bed. This is the case when the menses have ceased only for some days, or, at most, a few weeks. The advantages of the iodine are that it percolates through the tissues rapidly, killing the fœtus, at the same time preventing sepsis by its strongly-antiseptic nature. Besides, the tincture of iodine stimulates the uterus to contract, causing the expulsion of the tumor. (See also ABORTION, volume i.) Oehlschläger (Centralb. f. Gynäk., July 7, 1900).

II. CAUSES WHICH ARE DUE TO THE EXISTENCE OF PREGNANCY, THE PATIENT BEING APPARENTLY IN NORMAL CONDITION AT ITS INCEPTION.

1. *Mechanical Influences.*—These are among the most common of the causes which disturb pregnancy. They are usually traceable without great difficulty, and in some cases are susceptible of removal. In the greater number of cases, however, they persist as long as pregnancy persists.

(a) Pressure of the enlarged or displaced uterus upon contiguous structures. The conditions relating to the displaced uterus have been described. It is not until after the first half of preg-

nancy, as a rule, that the pressure of the uterus causes disturbance. One of the most common results of such pressure is disorder in the urinary function. Without discussing the various theories concerning the albuminuria of pregnancy it is quite evident that pressure is one of the causes, for the albuminuria usually ceases when pregnancy is terminated. When one realizes the susceptibility of the kidneys to floating and wandering it is not strange that they should occasionally get in the way of the enlarging uterus even when it is progressing in a perfectly normal manner. (See PARTURITION.)

Pressure of the enlarged uterus is also responsible for various other disorders. Pressure upon the intestines may cause obstruction in those viscera, and it often happens that the constipation which may be so troublesome during pregnancy is traceable to such a cause, especially when the pressure is directed upon the rectum.

Pregnancy plays no part as an etiological factor in the causation of appendicitis. The influence of appendicitis on pregnancy is, on the other hand, well marked. In 7 out of 22 cases abortion at about the fourth month resulted, either before or after surgical treatment.

The mortality in the 22 cases was: Maternal, 30.4 per cent.; foetal, 47.8 per cent.; consequently pregnancy renders the prognosis of appendicitis more serious. Treatment is that of appendicitis, the pregnancy not constituting a contra-indication. Early intervention is desirable. Bouillier (Thèse de Lyon, '97).

Pressure upon the stomach may cause more or less of the indigestion and gastric discomfort of the later months of pregnancy.

Pressure upon the liver, the gall-bladder, or the bile-ducts may account for jaundice, for nausea, and vomiting. Pressure upon the diaphragm causes some of the discomfort of the latter part

of pregnancy, the difficulty in respiration, and sometimes the irregularity of action which is manifested by the heart.

Pressure upon the bladder gives rise to much discomfort in not a few cases. The uterus may so rest upon this viscus that it cannot distend symmetrically as the urine enters it. This may cause such a condition of irritability that there will be a constant desire to micturate. Inability to empty the bladder completely often leads to decomposition of the residual urine, with resulting cystitis, which may persist long after pregnancy has ended. Disorders of the bladder are among the most annoying troubles from which pregnant women suffer. The results of the pressure of the enlarged uterus upon nerves and ganglia are not often sufficiently pronounced to excite attention. It is, of course, possible that the sacral nerves and the ganglia of the pelvis may be so encroached upon as to cause numbness or even paralysis of the lower extremities, on the one hand, and interference with the nutrition of the pelvic and abdominal viscera, on the other. The former condition has been observed by most obstetricians of experience in more or fewer cases, but I am not aware of any observations which have been made in regard to the latter.

(b) Disturbed circulation, either from immediate pressure upon vascular structures or arrest of the current in its ordinary channel.

The two primary conditions which may result from this factor are anæmia and congestion. Anæmia is experienced, of course, in the tissues which are immediately compressed. Such a result is usually transient, since the uterus does not normally exert its pressure over the same area for a very long time. It must change its position and the direction of pressure as it enlarges and emerges from

the narrow limits of the pelvis to the less restricted abdomen. If, however, it becomes agglutinated to any of the structures with which it is brought in contact, that structure may suffer, not only with anæmia, but with the more serious effects of malnutrition which follow as a consequence. Anæmia of the compressed portion is not, of necessity, attended with congestion of the contiguous portions, for the anastomosing circulation may be so perfect that the blood-current will adapt itself to the new and changed conditions. Such a fortunate result does not always occur; hence the frequent manifestation of congestions in various parts of the body in response to the obstruction which has been placed in the customary channel for the blood.

The veins of the vulva and legs furnish the most vivid illustrations of these obstructive conditions. They are frequently enlarged to an enormous size, and their rupture, especially those of the vulva, during parturition may be attended with the most serious consequences.

(c) Pressure upon the uterus by a new growth which has developed coincidentally with pregnancy. This complication is, of course, an unusual one. Pregnancy may incite abnormal activity in growths which were previously quiescent or not troublesome, or the first intimation of their presence may come with the obstruction which they cause during pregnancy. Ovarian cysts and fibroid tumors of the uterus furnish familiar examples of this form of obstruction. Less frequently seen are bony tumors of the pelvis, malignant growths of the pelvis and abdomen, and ascitic accumulations, with tuberculosis and with disease of the liver, spleen, and kidneys.

Scarcely one-fifth of all cases complicated by fibroids terminate without surgical interference, and about one-third of the mothers and one-half of the chil-

dren die during or soon after delivery in consequence of the morbid growths. Operations during early pregnancy give better results than those undertaken later, and enucleation *per vaginam* should be elected when possible. Sutugin (Wratch, Jan., '91).

From one hundred and thirty-five cases, in literature, of ovariectomy performed during pregnancy following conclusions are drawn: (1) complication of pregnancy with ovarian tumor is to be considered a very grave occurrence, in which, with few exceptions, extirpation of the tumor comes into question; (2) the further pregnancy progresses, the more dangerous is the situation; (3) the puncture of ovarian cysts and the production of abortion are to be considered only in an emergency; (4) ovariectomy gives the best results for the mother in the second, third, and fourth months of pregnancy, for the product of conception in the third and fourth; (5) if an early ovariectomy is not possible for various reasons, it is to be carried out in the later months of pregnancy, as good results can be even then expected. D. Sirne (Archiv f. Gyn., B. 24, H. 3, '92).

It is but seldom, notwithstanding their great frequency among child-bearing women, that fibroid tumors give rise to any inconvenience during pregnancy, and very rarely do they require surgical interference. Halliday Croom (Edinburgh Med. Jour., Oct., '92).

Ovariectomy strongly advocated during pregnancy. In 150 ovariectomies personally performed, 5 were done during pregnancy and 11 very soon after the puerperium. Of the 5 pregnant cases, 1 died of shock; but suppurative peritonitis following suppuration of the cyst and tension of the pedicle had set in before operation. In the other 4 little or no difficulty was encountered.

Out of the 11 cases of ovariectomy shortly after delivery, 2 died, in both cases from acute suppuration of the cyst. In all the 11 there were dangerous or troublesome complications. In all 150 cases suppuration of the cyst was only seen in 16. In half of these cases the complication was due to childbirth. Hence, ovariectomy in pregnancy is less

dangerous than expectant treatment and operation deferred till after delivery. The operation should be performed directly the tumor is diagnosed, preferably in the course of the first five months. Mangiagalli (*Berliner klin. Woch.*, May 21, '94).

Following conclusions reached regarding treatment of cancer of gravid uterus:

1. During the first three months vaginal hysterectomy is the operation of choice.
2. When the foetus is viable (seven and one-half months) the Cæsarean operation, immediately followed by total extirpation of the uterus and appendages, meets all the requirements.
3. Between four months and seven and one-half months, total abdominal hysterectomy should be practiced without delay.

Hernandez (*Annales de Gynéc. et d'Obstet.*, Aug., '94).

In ovarian tumors complicating pregnancy statistics show that pregnancy is interrupted in about one-third of the cases operated on, and therefore in the interest of the child it is better to wait as long as possible; nevertheless the tumors should be removed as soon as may be in case of pregnancy, especially if adherent. Staube (*Monats. f. Geburts. u. Gyn.*, Oct. 4, '95).

Six personal cases of fibroids complicating pregnancy, and not one resulted in serious complications. All the mothers lived, and five of the children. Therefore, with few exceptions, myomatous tumors of the uterus had better be let alone until the commencement of labor. Julius Rosenberg (*Med. Rec.*, Mar. 7, '96).

One hundred and sixty-six cases of carcinoma of the pregnant uterus collected since 1886. Conclusions as to best methods of treatment are: In cases of early pregnancy, when the disease has not yet extended beyond the cervix, vaginal hysterectomy should be performed at once; but if pregnancy is too far advanced to permit of extirpation by vaginal route, it is better to perform Freund's operation. Statistics show that vaginal hysterectomy, when performed in the early weeks of puerperium, does not appear to be attended with any additional risks. At full term Cæsarean

section followed by total extirpation is the ideal operation if the foetus cannot be born through the natural passages; but if there is any extension of growth into the parametric tissue, the Cæsarean section alone should be done. G. H. Noble (*Amer. Jour. of Obstet.*, June, '96).

Case in which a triplet pregnancy was complicated by the presence of multiple fibroids of the uterus. The patient was a primipara, aged 36, and pregnant about three months. The abdomen, however, was as large as at full term, and was rapidly increasing, and the woman's condition was precarious, so it was decided to open the abdomen. Uterus was found to be studded all over with interstitial and subserous myomata, and it was only after the whole mass had been removed by hysterectomy, and the uterine cavity laid open, that it was discovered that inside it were three foetuses in two bags of membranes. Age was three months. Patient made a good recovery. W. Jepson (*Amer. Gynæc. and Obstet. Jour.*, Aug., '97).

Hysterectomy in fibroid uteri in pregnant patients is demanded for four indications: (1) when, independently of pregnancy, the fibroid tumor would make hysterectomy justifiable; (2) when the fibroid occupies such a position that labor would be impossible; (3) when the tumor is degenerating or suppurating, and when a retained placenta complicates the case; (4) hysterectomy should be performed in a case of labor complicated by fibroid tumor of the uterus after the child has been extracted by Cæsarean section. Keiffer (*Gaz. Hebdom.*, No. 34, '97).

1. Solid neoplasms of the ovary complicating pregnancy are exceedingly rare.

2. The diagnosis may be difficult. In certain cases it may be aided by recto-abdominal palpation under narcosis, using Kelly's method to gently produce artificial descensus of the uterus. The physical examination with the signs of pregnancy, and those which belong more particularly to solid ovarian growths, generally enable us to make a probable diagnosis and one sufficient to warrant an exploratory section.

3. The prognosis in case of solid growths of the ovary complicating pregnancy is much worse, both for the mother and child, than in those of cystic neoplasms of these organs. Abdominal section and extirpation of solid tumors during the early months of pregnancy produce equally good results, so far as the foetus is concerned, as in case of cysts. The result to the mother depends on the malignant or benignant nature of the growth.

4. In extirpation during the second and fourth months of gestation the maternal mortality is but 5 per cent., due to hæmorrhage, shock, sepsis, etc., whereas the foetal mortality due to abortion is only 20 to 22 per cent., as compared with 40 per cent. for the former, and 80 per cent. for the latter, when those cases are left to unaided Nature.

5. The compulsory operation (during the latter part of gestation, during labor, or the puerperium) will rarely be required. Swan (Bull. Johns Hopkins Hosp., Mar., '98).

History of 6 cases in which uterine fibroids complicated pregnancy. In a general way, the rule may be established that, where the lower third of the uterus and the entire cervix are free from any neoplasm, the physician may safely await the result of the pregnancy, even if the fibroid is of considerable size. Ford (Med. News, Mar. 31, 1900).

Ovarian tumors which prevent the descent of the child may be punctured *per vaginam* and removed later, but if they are small they may be pushed up out of the way by having the patient in the Trendelenburg position. Fibroid tumors at or near the fundus seldom cause trouble at time of delivery, but they prevent the rapid contraction of the uterus, and unusual precautions must be taken against hæmorrhage. In the early months of pregnancy, if the location of the fibroid is such as to presuppose difficulty in the birth of the child, abortion should be performed, or, if this is impossible, hysterectomy. Otherwise it means a Cæsarean section, or a hysterectomy at term, with all their attendant dangers. G. W. Jarman (Annals of Gynæc. and Pæd., July, 1900).

Influence of fibroid tumors studied in 550 cases of myoma. The prevailing opinion as to the unfavorable influence of these tumors upon pregnancy and labor is not justified. Of the married women, 26.7 per cent. were sterile; but in very few cases was the sterility due to the myoma. Of the women who had borne children, the average number of pregnancies was 3.6, and only 22 per cent. of the 550 had been pregnant only once. The omission of conception may favor the development of these tumors, the hereditary disposition to which is about the same in all women. Considering the benign influence of myomata on the course of pregnancy, operative interference during gestation condemned except in exceptional cases. Hofmeier (Zeits. f. Geb. u. Gyn., B. 42, H. 3, 1900).

2. *Nervous Reflexes*.—It would be difficult to refer to all the possible disorders of this character. The nerve-connections of the uterus with other parts of the body, especially with the abdominal viscera, are so numerous that there is a certain degree of reasonableness in attributing a great variety of nervous disturbances to a cause within the uterus. A woman with highly-developed nervous system may be peculiarly sensitive to irritation when the uterus is in an exalted state of functional activity, and thus we may explain many of the peculiar phenomena of pregnancy. Perhaps the most common of these phenomena are the nausea and vomiting: the "morning sickness" of pregnancy. Others which are less noteworthy are neuralgias in various parts of the body, peculiar conditions of the special senses, disturbances of digestion, secretion, etc. The nexus between these conditions and pregnancy seems to be demonstrated in the fact that with the termination of pregnancy the conditions in question disappear also.

Forty-nine cases of peripheral neuritis in pregnancy and the puerperal state collected. The disease is more com-

mon in multiparæ. One-fourth of the cases occurred during pregnancy, while in one-third there was a history of some form of sepsis. In 11 cases marked and incessant vomiting was present. It was not possible to trace a connection with alcoholism, and sepsis and continual vomiting are the most potent causes. The disease began in the legs, then extended to the arms. The muscles were wasted and there were disturbances of sensation. In 14 cases there was either no recovery or but partial cure. In 22 cases recovery was complete, while in 13 no mention was made of the termination. Reynolds (Brit. Med. Jour., No. 1920, '97).

Unlike hysteria and epilepsy, chorea constitutes a serious complication of pregnancy; the mortality has been variously estimated from 30 to 28 per cent.; sudden death has been reported among such patients. In fatal cases death ensues from asphyxiation, the patients becoming paralyzed and often maniacal. In 20 per cent. abortion happens, or premature labor. Many of these women were rheumatic or chlorotic before pregnancy. Tarnier (La Presse Méd., No. 29, '97).

Influence of maternal nervous lesions on the vitality of the fœtus studied, through the production in pregnant rabbits of sciatic neuritis and meningo-myelitis. Neither of these conditions, produced in rabbits a certain time before term, caused the death of the fœtus before that of the mother, the latter having been killed a short time before term in order to ascertain the condition of the fœtus. L. Butte (Jour. de Méd. de Paris, Feb. 22, March 1, 1903).

3. *Nutritive changes*, especially in the blood, nervous system, digestive apparatus, and secretions. Pregnancy is certainly the expression of a physiological requirement in animal nature. Normally it should be attended by no unusual phenomena; but unfortunately the absolutely normal type of pregnancy is seldom seen. The variations in connection with the nutritive functions are especially pronounced. In a general way it

may be said that exaltation is the characteristic in one class of cases and depression in another.

With the former the improved condition of the tissues shows the comparative gain in volume and nutritive value of the blood; the mind and nervous system, which may have been in a condition of irritation, are now so calm and equable that the change becomes noteworthy to those who are familiar with the state of affairs prior to impregnation. The digestion is improved, the secretions by their abundance show the activity of the entire glandular apparatus; in a word, pregnancy has acted as a stimulant and tonic, and such women frequently declare that they have never felt better in their lives than when pregnant. This is the exaltation which may be coincident with pregnancy. In the other class the very opposite is seen: anæmia becomes more and more marked as pregnancy advances, nervous and mental irritability and depression are more or less constant, melancholia and mania being not infrequent; digestion is constantly disturbed, nothing seems to be well assimilated, nausea and vomiting cause great annoyance, and the secretions are deficient in quantity and impaired in effectiveness. This is the depression which may also be the accompaniment of pregnancy.

III. CAUSES WHICH ARE DUE TO PREGNANCY PLUS ADDITIONAL PROVOCATION FROM WITHIN OR WITHOUT THE INDIVIDUAL.

1. *Improper Diet or Habits*.—There are few subjects about which even intelligent people err more grievously than as to their diet and their ordinary habits. The selection of suitable food is at all times a subject of the first importance, and when those who suffer with the ills of pregnancy suffer also from the use of

improper food, whether this be the result of necessity, or of ignorance, or of willfulness, the consequences are pitiable, for Nature is no respecter of persons. The sufferings in these cases are primarily, of course, related to the digestive apparatus, indigestion, constipation, nausea and vomiting, and loss of appetite being most conspicuous; but other portions of the economy may become involved, until confusion and anarchy prevail. The influence of improper habits in accentuating the disorders of pregnancy is a fact which is continually presenting itself. It is only necessary to mention in this category the unfavorable influence of overwork, insufficient sleep, the excitement of life in society, alcoholic excesses, and frequent coitus, to illustrate the possibilities of disturbance which may occur, and which in very many cases are entirely unnecessary and avoidable.

The size of the offspring depends very directly upon the diet and nutrition of the mother during pregnancy. While this explains the easy labors among the healthy lower classes and confirms Prochownick's conclusion that by dieting the mother the children of rickety women may be so reduced in size as to be viable, it also probably helps to explain the very high infant mortality among the very poor. The infant starts life at a low level and readily succumbs to the hardships to which it is too often subjected.

To the physiologist the point of chief interest seems to be the demonstration of the limitations in the extent to which the tissues of the mother can be utilized for the construction of the embryo. The nourishment of the maternal tissues seems to take precedence over the nutrition of the fœtus. Were this not the case, had the embryo the prior claim to nourishment, we should find that in badly nourished mothers each gramme would produce a greater proportionate weight of young than in well-nourished

mothers. This is exactly the reverse of what occurs. The mother thus appears to pass on the *surplus* nourishment to the fœtus and the better the nutrition of the maternal tissues the greater is the growth of the young in utero. D. Noel Paton (Lancet, July 4, 1903).

2. *Trauma*.—Injuries of various characters are not inhibited nor prevented by pregnancy. Some of them may be considered mere curiosities; for example, the tearing open of the pregnant womb by the horns of cattle, early delivery by Cæsarean section because of extensive pelvic deformity, kicks in the abdomen and other brutal treatment, penetration of the vagina and uterus by sticks or other hard objects, accidentally or intentionally. All these causes may produce intense disturbance: the delivery of the ovum, pain and inflammation, sepsis, and even death.

3. *Nervous and Mental Irritants*.—There are many causes of this nature which produce disturbance of one kind and another during the pregnant state. Sudden emotions of fear, surprise, grief, anger, etc., may produce unusual results, owing to the extreme sensitiveness which many women experience while pregnant. With one woman the result will be a general sense of pain or a neuralgia in some particular nerve or set of nerves. With another the result will be nausea with or without vomiting, with another diarrhoea, while with others the uterus will be excited to contraction and its contents expelled. A very common result from such excitants is incontinence of urine, the urine being voided involuntarily with the slightest nervous or mental impression of an unusual character. The birthmarks or stigmata with which many children come into the world are often traceable only to mental impressions or a disordered imagination, and many of the

monstrosities among infants may be fairly accounted for in this way. A woman whose mind is diseased may produce a persistent impression upon her unborn child which will manifest itself at a later period upon the child's physical or mental structure. Women with organic disease of the nervous system may so impress their offspring that they will succumb during the gestation period, or if carried to term will be of such defective structure that their entire lives will be burdensome to them.

4. *Intercurrent Disease*.—Of this form of irritant the eruptive fevers furnish a familiar example. Any acute disease developing during pregnancy may not only be of a more severe type than would ordinarily occur, thus intensifying the patient's discomfort and suffering, but it may even cause the death of the child or its premature delivery, either alive or dead.

In closely observing 432 cases of small-pox in women under 50 years, particular note made of 80 who were pregnant. Of these 15 per cent. died, while the mortality of the non-pregnant cases was 11.08 per cent.

Pregnancy increases the predisposition of a patient to the graver forms of variola. In the 80 cases, confluent small-pox was seen in 4 and hæmorrhagic in 6 cases; all the 10 died. In the 352 non-pregnant cases the confluent form was observed in 3 and the hæmorrhagic in 11 patients; 2 of the confluent cases recovered. Two pregnant women died of milder forms; of the total, 12, there died 5 undelivered, the most of the others very shortly after birth without any trace of puerperal infection. Of the primiparæ, 9 per cent. died; of the multiparæ, 17.25 per cent.; 6.25 per cent. of women attacked by small-pox early in pregnancy died, while the mortality of those who were infected later amounted to 20.83 per cent. Abortion or premature delivery was noted in 23 of the 80 cases during the course of the attack of small-pox. In 6 the same took place

after convalescence from the disease; 16 children were delivered alive in cases where the small-pox was still in progress, 8 at term, and 8 prematurely; only 3 lived longer than six months. Several died of variola; 2 were clearly born with it. Van der Willigen (Nederland. Tydschr. voor Geneesk., No. 11, '95).

Hypothesis that the occurrence of tetany during pregnancy depends primarily upon some abnormality in the function of the thyroid gland, and it is the unusual demands made upon this organ in the later months of pregnancy which make this such a favorable time for the occurrence of the attacks.

Opinion entertained that it is probable that tetany occurring under other conditions will in most cases be found to be due to an insufficiency, absolute or relative, in the action of the thyroid gland or like structures. H. M. Thomas (Johns Hopkins Hosp. Bull., May, June, '95).

In last epidemic of influenza numerous cases of metritis or metroperitonitis in the last months of pregnancy were recorded. Severe hypogastric pain set in, and proved very obstinate. It became complicated within a few days or weeks with phenomena of delivery and child-bed, and often proved serious in consequence. Usually the complication passed off with an attack of herpes labialis or urticaria. Coughing was frequent, and increased the local condition; fever was never high. Quinine, morphine, rest in bed, and very careful watching during convalescence usually effected a cure. Hennig (Centralb. f. Gyn., No. 6, '96).

Influenza is generally mild in the pregnant woman. If, however, the attack is severe, pregnancy is always interrupted. Hintze (Centralb. f. Gyn., p. 1311, '96).

5. *Irritating Conditions Associated with the Ovum*.—Such conditions may consist in disease which has been transmitted from the mother (*e.g.*, syphilis), or there may be diseased conditions of the placenta or membranes which may react upon the mother. Especially if death of the ovum takes place and it then remains within the mother's body

it may be a source of disturbance to her. One of the most distressing illustrations of such possibilities is the wide range of untoward phenomena which are connected with ectopic gestation. There is perhaps no accident to which a pregnant woman is susceptible which brings with it such terrible consequences as this. That some women escape the serious results which so often happen when this condition is undiscovered and untreated by the surgeon's art is no contradiction to the truth of this assertion.

Disorders of Pregnancy.

Certain salient conditions are frequently conspicuous and troublesome in connection with the pregnant state. These conditions will be considered under the following category: Nausea and vomiting. Ptyalism. Displacements of the uterus. Embolism and thrombosis. Ectopic gestation. Pruritus vulvæ. Œdema of the external genitals. Œdema of the lower extremities. Œdema of the upper extremities. Hæmorrhoids. Uterine pain, or cramps. Spurious pregnancy. Concealed pregnancy.

Nausea and Vomiting.

This most familiar and sometimes most troublesome condition is perhaps also the most common of all the disturbances peculiar to the pregnant state. It is not peculiar to the dyspeptic and hyperæsthetic woman alone, it occurs with all temperaments without partiality and may be most annoying to one who is least subject to physical or mental instability. The cause of this disturbance is plainly an irritability of the extensive nerve-supply of the uterus, which is subjected to an unusual—even though it be a physiological—stimulus. The nexus between the sympathetic nervous system of the uterus and the nerve-supply of the stomach by way of the hypogastric plexus is ample for the passage of impressions of

irritability from the one viscus to the other, and it is a referred or transferred irritation of this kind which causes the troublesome gastric disturbance. The disturbance begins soon after the uterus begins to enlarge, and continues with more or less persistency until the uterus is well out of the pelvis; that is, until the sixth or seventh month of gestation, or even until its termination.

Analysis of the urine in hyperemesis gravidarum. The products of metabolism normally excreted—such as indol, skatol, and ethyl-sulphates—are found in increased amount. Abnormal constituents—namely: albumin, urobilin, acetone, and peptone—occur in the urine. Acute nephritis may occur. A similar condition of the urine and kidneys is found in many acute infectious diseases. E. Dirmoser (*Wiener med. Woch.*, Oct. 7, '99).

There is simple nausea with or without actual emesis of physiological and reflex origin, a symptom only due to hyperæmia, the developing uterus, vessels, and nerves in a confined cavity. Malposition of the uterus, if the cause of so many troubles in ordinary conditions of health, must be a graver trouble in the pregnant woman, and thus increases the vomiting of pregnancy and consequent malnutrition and emaciation. In the absence of uterine troubles and organic disease, hysteria plays an important rôle, and usually defies all therapeutical remedies. If operation should be deemed necessary, it should be carried out under thoroughly antiseptic conditions and anæsthesia.

It is probable in pregnancy, with its increased arterial tension, and where lung and cardiac complications exist, gastric irritation may be set up and continued in consequence of the special toxæmia which at present is only suspected, but which in further researches, the writer is convinced, will be scientifically proved. J. M. H. Martin (*British Medical Journal*, Dec. 10, 1904).

With some women it is an accompani-

ment of the first pregnancy only, and this is especially true with women who are pregnant for the first time after the tissues are all mature and firm: *e.g.*, after the thirtieth year of life. With others it recurs as often as pregnancy recurs. It is familiarly known under the name of "morning sickness," and is apt to manifest itself when the patient awakens in the morning. If she remain quiet in bed nausea may be the only symptom, and even this may be wanting, but the moment she rises and makes any effort, however slight, nausea with vomiting may result. The ingestion of food usually adds to her discomfort. It may be quickly rejected or it may become a disagreeable burden to be thrown off at a later period, or eventually it may be digested and assimilated. The disagreeable symptoms may wear away as the patient becomes occupied with her ordinary daily cares, or it may persist with obstinacy, unyielding from morning to night. Very few women are able to dispose of it by mere mental effort, and it may become so troublesome that the resulting weakness and malnutrition will prohibit attention to the daily duties. The patient may be obliged to keep her bed and even her life may be in danger from inability to retain sufficient nutriment. I have seen one such case in nearly twenty years of practice.

Three hundred cases of vomiting in pregnancy noted at the General Lying-in Hospital, and following conclusions arrived at: 1. About one-third of the cases had no vomiting during the first three months of pregnancy. No diagnostic importance can, therefore, be attached to it in first part of gestation. 2. In cases in which vomiting occurred it was present in the first months in 70 per cent.; it appeared in the last three months in 10 per cent. The maximum was observed in the second month. 3. The vomiting was most frequent in patients

between 20 and 25 years of age. 4. It was present in 90 per cent. of the primiparæ. 5. There was less vomiting in the third pregnancy than in any of the others. 6. When vomiting occurred in the first three months, it increased with the weight of the placenta and child; but its influence was felt on the nutrition of the mother and not on that of the child. 7. Patients who suffered from dysmenorrhœa before pregnancy were less affected with vomiting than those in whom menstruation had been easy. Giles (Brit. Med. Jour., July 22, '95).

Ordinarily the vomiting of pregnancy is a comparatively insignificant affair. It begins shortly after conception, lasts from one to four months, and is easily controlled, or passes away without treatment. It occurs before and after eating, and the rejected matter is chiefly mucus, or mucus mixed with the food that has been ingested. The patient loses little flesh or strength. Again, it passes into an uncontrollable form, which at first is difficult of differentiation. Usually constant nausea and salivation are then present. The rejected material consists of mucus, food, or bile, and the vomiting may be either painless or painful. There are remissions permitting the ingestion of food; but later this becomes impossible, and loss of flesh and physical and mental depression occur. This marks the beginning of the second period, in which all the former symptoms are intensified, and constant fever and vomiting are added. The third period is recognized by the development of cerebral symptoms; the vomiting ceases, there are delirium, hallucinations, neuralgias, and finally coma and death. Pozzi (Ther. Woch., No. 37, '97).

Autopsy in a case of pernicious nausea of pregnancy. An active secondary nephritis was found in both kidneys. The brain, the heart, and the lungs presented no lesion, but the liver was greatly altered. It presented a blanched appearance, with small yellow areas. A large infarct was found upon the lower portion, which had succeeded necrotic parenchymatous tissue. The lesions were those of an active toxæmia of hepatic origin, with multiple hæmor-

rhages. The lesions greatly resembled those often seen in eclampsia. De Ribes (*Comptes-rendus de la société d'Obstét. de Paris*, vol. iii, 1901).

Treatment.—The first essential of treatment is rest, as in gastric disturbance from any cause. Rest in bed may be all that will be required, the woman gradually resuming her duties as the stomach becomes less irritable.

Review of the theories of various authors as to etiology of hyperemesis gravidarum, and the different lines of treatment advocated, summarized as follows:—

1. With Kaltenbach and Frank the term should be limited to those cases in which the vomiting is set up and kept up by the pregnancy, and the patient's nutrition suffers.
2. The reason of the hyperemesis in Kaltenbach's restricted sense is to be sought in a neurosis (Ahlfeld) or hysteria.
3. In the treatment of hyperemesis of the first and second degrees dietetic treatment by the limitation of nourishment to liquids, with mental and bodily rest, is sufficient.
4. If treatment at home is not successful within a few days, treatment in an institution must be proposed.
5. If the vomiting does not then stop, the patient must be transferred to an institution.
6. Local treatment (with the exception of the treatment of dangerous complications, such as retroflexion of the gravid uterus) and treatment by drugs and suggestion are superfluous.
7. In hyperemesis of the third degree the artificial induction of labor is occasionally required.
8. To avoid this the earliest practicable treatment of the hyperemesis in the first and second stages is necessary. Klein (*Zeits. f. Geburts. u. Gyn.*, vol. xxxix, pt. 1, '99).

Lavage of the stomach with normal saline solution at a temperature of 100° F. will sometimes bring relief. The faradic current to the epigastrium has been recommended.

Uncontrollable vomiting of pregnancy successfully treated by faradization of the vagi before or after meals. Benefin (*Der Frauenarzt*, Sept., '95).

In hyperemesis gravidarum the stomach should be washed out by a solution of boric acid; the gases of the stomach should be absorbed by powdered charcoal made from the wood of the lime-tree, and food should be given by the rectum. When the patient is eventually able to take food by the mouth, it should at first consist of somatose and rice-water. Dirmoser (*Lancet*, vol. 1, No. 10, '97).

Blistering the cervical vertebræ, often recommended in vomiting of pregnancy, is generally useless and only adds to the discomforts of the patients. Unmarried women are not often afflicted. Limited sexual intercourse or absolute abstention should be enjoined. Pathological vomiting is not the vomiting of pregnancy, but vomiting *in* pregnancy. McDonald (*Montreal Med. Jour.*, Sept., '97).

In the treatment of vomiting of pregnancy, following suggestions offered: 1. The abnormal irritability of the nervous system, including the vomiting-centre, is to be allayed by keeping the patient in the horizontal position, by attention to the skin and bowels and kidneys, using rectal and, if necessary, hypodermic injections of salt solution. 2. The hysterical condition which is so commonly found present should be controlled by strengthening the will and influencing the dominant idea of the patient. 3. All sources of peripheral irritation should be discovered and treated. 4. In extreme cases subcutaneous saline injections serve the threefold purpose of (a) diluting the blood and increasing vascular tension; (b) eliminating toxins through renal and intestinal emunctories; (c) furnishing two most important kinds of food. 5. Induction of abortion is never indicated. At a stage when it is safe and efficient it is not necessary; and in extreme cases it adds greatly to the danger, rarely stops the vomiting, and can be substituted by the artificial serum. Bacon (*Amer. Jour. Med. Sci.*, June, '98).

Copeman's plan of dilating the cervix with steel dilators has been pronounced very efficient, but it will not always succeed.

Case of hyperemesis gravidarum for

which various remedies had been used without success, until it was decided to empty uterus. In thirteenth week cervix was packed with iodoform gauze, with the woman in Sims's position. Vomiting immediately decreased, and in twenty-four hours ceased entirely. Abortion did not take place, and woman went on for another twelve weeks perfectly well. Then vomiting began again as violently as before, and in the twenty-sixth week gauze tamponade of cervix was repeated. Once more vomiting was greatly relieved, though not entirely stopped. A third time, in thirtieth week, vomiting became so severe that the cervical tamponade was used, and following this the vomiting again ceased entirely. In the thirty-third week vomiting recurred, and, as child was viable, pregnancy was terminated, living child being obtained and mother made a good recovery. F. A. Kehrer (*Centralb. f. Gyn.*, Apr. 11, '96).

Dilation of the cervix relieves vomiting of pregnancy very promptly in some cases, in others within a few days. As regards the ultimate procedure of emptying the uterus, the general tendency is to delay too long the operation, one which in itself is not without danger, especially in patients whose vitality is very low from inanition. Gardner (*Brit. Med. Jour.*, Oct. 23, '97).

Two cases that had resisted absolutely all other measures were permanently cured by the following: Etherizing the patient, dilating the cervix slowly and carefully to the width of about an inch, and then painting the cervical canal with Churchill's tincture of iodine thoroughly. F. W. Johnson (*Boston Med. and Surg. Jour.*, Mar. 21, 1901).

As to the drug treatment, one may use a mixture containing

℞ Bismuthi subnitr., gr. x.
Cerii oxal., gr. v.
Sodii bicarb., gr. v.
Cocainæ mur., gr. j.

This may be taken dry, upon the tongue, or the cocaine alone may be used. Dilute hydrocyanic acid, in 1-drop

doses, or pure carbolic acid, in 1-drop doses, are sometimes efficient.

Nine cases of vomiting of pregnancy in which orexin tannate yielded good results. As a rule, the desired effect was obtained after only a few powders had been given, and remained permanent even when the use of the remedy was suspended. F. Hermann (*Ther. Monats.*, xiii, p. 24).

Oxygen-water employed with very great success in the treatment of the vomiting of pregnancy. Inhalations of oxygen are also useful. The oxygen-water employed contains 10 volumes of the gas, and is administered in the dose of 1 teaspoonful to the ounce, diluted with an equal quantity of water; to be taken in half to one teaspoonful at a time. Gallois (*Jour. des Pract.*, Mar. 20, '97).

Orexin given in doses of $4\frac{1}{2}$ grains, two or three times a day, followed by a little cold fluid, water or milk, has proved very prompt in relieving hyperemesis gravidarum. R. Frommel (*Therapist*, June 15, '98).

[Ingluvin in doses of 5 to 10 grains three or four times a day is frequently followed by marked success in controlling the vomiting. Ed.]

Cocaine in capsules— $\frac{1}{2}$ grain of cocaine to 3 of monobromate of camphor—will invariably stop the vomiting of pregnancy. Dudley (*Amer. Jour. of Obstet.*, Feb., 1900).

The treatment that has been generally satisfactory personally in the nausea and vomiting of pregnancy is feeding the patient day and night. Of course, one cannot expect to get permanent relief in all cases; but feeding the patient, constantly feeding her, gives the most relief and comfort to the patient. A pregnant woman, with nausea and vomiting, then should have a glass of milk, crackers, oranges, or anything else she may take a fancy to, setting on a table near her bed at night so she can satisfy her hunger at any time. Before rising in the morning she should have a good substantial meal, consisting of coffee, milk, eggs, mutton-chops or beefsteak, buttered toast, or whatever else she may

fancy. After partaking of her breakfast in bed she may arise, and during the day thereafter she may take about three more substantial meals. Fasting during the night is conducive to sickness in the morning and possibly during the ensuing day. J. M. Batten (Phila. Med. Jour., Mar., 1901).

Eight cases of persistent vomiting of pregnancy treated by systematic saline injections, preferentially by the rectum, of from 3 to 4 litres of artificial serum daily, in divided doses of 300 cubic centimetres (10 ounces) each. The injection is made so slowly as to occupy from ten to fifteen minutes, and is arrested if it produces peristalsis, to be recommenced when the movements have ceased. Should there be intolerance a few drops of laudanum may be added, or, if necessary, the serum may be introduced hypodermically. During the ten days or so that the treatment is continued the patient takes neither liquids nor solids by the mouth, and then, while the injections are continued for several days, oral nourishment is gradually increased from a few mouthfuls to the ordinary quantity. This treatment is based on the idea that the persistent vomiting of pregnancy is due to general intoxication, and averted the necessity of inducing abortion in any of the eight cases in which it was adopted. Condamin (Lyon Médical, Feb., 1902).

Finally there remains the emptying of the uterus as a last resort, and only as a last resort. It should only be done after careful deliberation and with the approval of skilled counsel. It should never be done merely to please or satisfy the patient or her friends.

When the patient shows signs of exhaustion as manifested by rise of pulse to 115 or 120, and the vomit becomes dark brown or blackish, abortion should be induced without delay. This should be done under *anæsthesia* in most cases. Mauray (Brit. Med. Jour., Oct. 23, '97).

Ptyalism.

This complication is far less common than the previous one. It consists in an aggravated irritability of the salivary

glands, the saliva being poured out in an almost constant stream. It is apt to occur with primiparæ, and in the first three or four months of pregnancy. Its effect is to weaken the patient and impair the digestive function. The quantity of saliva secreted in the twenty-four hours may amount to one or more pints. The saliva may be purely fluid or watery, or it may be mingled with an abundance of mucus, and be thick and ropy.

Treatment.—There is no remedy for this trouble which compares in efficiency, so far as I am aware, with the sulphate of atropine, which may be given in $\frac{1}{130}$ -grain doses repeated every three or four hours until physiological effects are apparent.

Two cases of ptyalism during pregnancy. In one case the cervix was cauterized, and bromides and cocaine were given, and, later, atropine, with good results. In the second case this treatment was without result, and abortion was procured. This was followed by cessation of the salivation. Lvoff (Centralb. f. Gyn., No. 29, '97).

Displacements of the Uterus.

This condition may be present when pregnancy begins or it may be acquired at any period of gestation. The subject has already been alluded to in the foregoing pages. The displacement may be lateral, anterior, or posterior, and it may be more or less exaggerated. It may be simple or it may be complicated by adhesion of the peritoneal surface to the contiguous peritoneum. Whether the adherence exists at the beginning of pregnancy or is acquired subsequently, it is always an unfortunate—not to say a dangerous—complication in so far as the continuance of pregnancy is concerned.

Lateral displacements are usually least significant in so far as disturbance to the pregnant state is concerned. If there are no adhesions the uterus usually corrects itself as pregnancy advances, and if no

other complication supervenes parturition will follow in the natural sequence and involution will restore the organ to its normal place and relations in the pelvis. If adhesions exist or are acquired they may be pulled apart as the uterus enlarges, or their firmness may be such that they will not yield, uterine contractions being excited and the uterine contents expelled, or the latter may require removal at the hands of the physician. Anterior displacement may be slight or extensive and the uterus may or may not be adherent to the bladder. If the displacement is slight and there are no adhesions, spontaneous correction will result as the uterus enlarges and no further difficulty from this source may follow.

If the displacement is extensive, the subsequent enlargement of the uterus will be asymmetrical, the function of the bladder will be encroached upon, and there will be constant irritation of that viscus, with frequent micturition, and possibly the development of an annoying cystitis. This may continue until the end of pregnancy, or the irritation may be so great that uterine contraction and abortion will result. The danger of this mishap is greatly increased if the uterus has become adherent to the bladder. After the uterus has been emptied the union to the bladder may persist with such annoying symptoms that a surgical operation may be required to effect relief.

Should the uterus be displaced posteriorly the difficulties and dangers will usually be greater than in either of the other varieties of displacement.

The uterus may be merely retroverted or it may be acutely retroflexed. If the former, and there are no adhesions, Nature may again correct the trouble and no further difficulty ensue. If adhesions are present, the enlargement of the uterus will almost certainly produce such

irritation that contractions and abortion will follow.

In 24,000 pregnant women Martin found 121 cases of retroversion and retroflexion, and in 94 cases retroversion persisted after repeated pregnancies. A Mantle (Quart. Med. Jour., July, '97).

Pregnancy probably occurs more often in cases of retroversion than is commonly supposed. Reposition can generally be effected. If unsuccessful, cœliotomy is a better course than production of abortion, as it is practically without risk to the mother, and in most cases saves the fœtus. Eleven cases dealt with in this way; in 10 the patient's pregnancy went on to term; in only 1 abortion took place, four days after operation. Jacobs (Jour. d'Accouchements, Apr. 10, '98).

In cases of incarcerated retroversion of the gravid uterus, when all attempts at replacement *per vaginam* have failed, instead of inducing labor abdominal section should be performed and the fundus pulled up by the hand introduced behind it. If the uterus completely fills the pelvis, attempts at replacement from below must fail. M. D. Mann (Amer. Jour. Obstet., July, '98).

Partial retroflexions of the gravid uterus are generally due to an incarcerated retroflexion which has remained unreduced, the enlargement of the uterus into the abdominal cavity having taken place chiefly at the expense of the anterior wall of the organ. A similar bulging of the posterior wall may result from perimetritic adhesions, or from its being kept down by tumors or by a contracted pelvis. The prognosis in the extreme degree of retroflexion is very bad. Dührssen (Archiv f. Gyn., B. 57, S. 70, '99).

Case of pregnant uterus resting in the position of lateroflexion which was mistaken for an ovarian cyst. Notwithstanding laparotomy the pregnancy continued to term and the patient was delivered of a living child weighing 3500 grammes. Lateroflexion of the pregnant uterus may be confounded with ectopic pregnancy, ovarian cyst, or salpingitis. Concordance with Mauriceau in the im-

portance of making the diagnosis as early as possible in order that the displacement may be corrected. The expectant plan may be adopted or, if the flexion is so strong and irreducible as to be incompatible with the normal evolution of the pregnancy, an exploratory incision should be performed and the uterus freed. M. H. Varnier (*Anales de Gynéc. et d'Obstet.*, Feb., 1901).

Case of right-sided lateroflexion of the pregnant uterus which was mistaken for an extra-uterine pregnancy. Laparotomy was performed; the uterus was replaced, but abortion followed. The patient made an uninterrupted recovery otherwise. Routier (*Annales de Gynéc. et d'Obstet.*, Feb., 1901).

When the uterus is acutely retroflexed it is possible that the displacement may be remedied as it enlarges, but one must not depend too much upon the unaided effort of Nature. It will be far better to place the patient in the knee-elbow position, restore the organ to its normal position with the fingers, and then secure it with a tampon or a suitable pessary.

Many cases are susceptible of relief by such means which would otherwise terminate in abortion. If the uterus is retroflexed and also fixed by adhesions, relief may be obtained by the judicious use of the tampon or pessary, or the adhesions may be liberated as the organ enlarges; but in the majority of cases an abortion will be the result. With this displacement there are usually various annoying complications: the rectum is irritable from the constant pressure upon it and a troublesome diarrhœa or an equally troublesome constipation may ensue. Relief will come only when the cause has been removed. The bladder may also give trouble, owing to the constant traction at its neck, and the patient will be distressed with constant desire to micturate, each effort being followed by tenesmus. All things considered, uterine displacements bring about as much dis-

comfort as any of the disorders to which the pregnant woman is subject.

In retrodisplacements of the pregnant uterus spontaneous cure will be limited by four factors: adhesions, the sacral angle, the character of the displacement, and the degree of the displacement. If displacement be not corrected by Nature or art, sometimes pregnancy goes on to full term, the uterus becoming sacculated; much more frequently abortion takes place.

These retroflexed uteri have naturally much difficulty in expelling their contents. Challeix has reported 3 cases of extreme flexion in which the fœtus was retained 8, 5, and 1 month, respectively, after its death. If abortion does not take place grave results are generally not long delayed. Gottschalk has collected 67 deaths from this cause, and 10 more personally found, making a total of 77. Of these 13 were from rupture of the bladder, 18 from uræmia, and most of the others from sepsis, its origin being practically always in the bladder. Malcolm Storer (*Boston Med. and Surg. Jour.*, Mar. 9, '99).

Embolism and Thrombosis.

Enlargement of the veins during pregnancy is not an unusual occurrence. The veins of the lower extremities and the vulva are most frequently implicated. The condition is less common in primiparæ than in multiparæ. If the blood-tension is weak the formation of thrombi is favored. Portions of these thrombi may be detached as emboli and, passing onward, may find their way into the arterial circulation, especially into the arteries of the lungs and brain. When arrested in these vessels the most violent symptoms may ensue: pain, dyspnœa, effusion, even death. Such accidents, however, are more frequently the sequences of labor, especially when the thrombi are formed within the uterus at the site of the placenta. Pregnant women who suffer with varicose veins should always be cautioned against vio-

lent exertions or anything which would tend to the formation of thrombi, or to their disintegration when formed. The treatment in such cases must necessarily be expectant and stimulating, the patient being kept in bed most of the time upon fluid diet. If it is necessary or desirable that she should be up and around, the feet and legs should be bandaged, but not too firmly.

Ectopic Gestation.

This terrible complication rarely exists as an accompaniment of uterine gestation, though such cases are not unknown. It will be considered at this time only or mainly as a complication of pregnancy, and not with that detailed statement which would be required in connection with the unimpregnated uterus.

Case of extra-uterine pregnancy associated with an intra-uterine gestation operated upon by abdominal section, with recovery. Review of literature of 28 cases of combined extra-uterine and intra-uterine pregnancy, 21 of which the writer has been able to confirm. Thirteen of the patients were advanced in pregnancy, and these showed a mortality by all methods of treatment of nearly 54 per cent. There is but little doubt that labor should, in such cases, be allowed to be completed, and that then the extra-uterine sac should be treated by laparotomy. Phillips (*Lancet*, Oct. 25, 1902).

The ectopic-gestation sac usually ruptures from the sixth to the tenth week of its history and it would be almost an impossibility for ectopic gestation to occur after utero-gestation had been established. If, therefore, the two conditions co-exist, the former will usually begin coincidentally with the latter or a short time—a few weeks—previously. Utero-gestation usually causes the abeyance of menstruation, but when it co-exists with ectopic gestation one of the

first symptoms indicative of the situation will be hæmorrhage. This may appear at the customary time for menstruation, thus misleading the patient with regard to her condition, or it may appear a few days or weeks subsequently. But it will differ from the customary menstrual flow by its continuance after the usual duration, and also by its greater abundance. This fact may serve to warn the patient that her condition is not that which attends ordinary menstruation. The bleeding may or may not be attended by the discharge of shreds of decidua, this being by no means a constant symptom.

A more forcible indication of the patient's condition will be pain, which signifies both a stretching of the abnormal-gestation sac and its subsequent rupture with hæmorrhage either into the peritoneal cavity or into the space between the folds of the broad ligament. The pain is sharp and cramp-like; recurs in frequent paroxysms, and may be so severe that it, in connection with the accompanying concealed hæmorrhage, may result in anæmia and collapse. If the rupture occurs at a very early period the foetus (ectopic) may die and be absorbed together with the effused blood. The uterine gestation may terminate with an early abortion; but this rule need not be considered invariable. There is very little literature upon this phase of the subject.

When any woman, who has menstruated regularly and who has passed her period from four to twelve weeks, is suddenly seized with pain in either iliac region, becomes faint, dizzy, nauseated, pale, generally unable to sit up, tender and sensitive over lower part of abdomen, having a frequent desire to go to stool without being relieved, and when, upon vaginal examination, a boggy mass is found at one side and posterior to the uterus, and a slight, bloody, shreddy, mucous discharge occurs, she has the

classical symptoms of a ruptured tubal pregnancy. H. D. Ingraham (Buffalo Med. Jour., Aug., '95).

Extra-uterine pregnancy may be mistaken for (1) pyosalpinx with amenorrhœa; (2) myoma; (3) simple abortion; (4) retroflexion of the gravid uterus; (5) antelexion of the gravid uterus, and (6) twisted pedicle tumors: (a) of the tube and (b) of the ovary. J. W. Taylor (Brit. Gynæc. Jour., Nov., '98).

Pain alone, when not accompanied by a clear history of menstrual irregularity, symptoms of pregnancy, and the presence of a tumor at the side of the uterus or in Douglas's pouch, known to be of recent development, is pathognomonic of extra-uterine pregnancy only under certain conditions, viz.: the pain is of a sharp, colicky character, distinctly localized on one side, attended with faintness more or less marked, and is usually followed by intervals of hours or days of complete remission. The pulse is accelerated during the attack, but there is no rise of temperature. The latter is an important symptom distinguishing ectopic from inflammatory conditions. The violent tearing pain attending intraperitoneal rupture is accompanied by the unmistakable evidences of internal hæmorrhage. In extraperitoneal rupture the symptoms vary in severity according to the amount of blood lost, but soon subside, being succeeded by the usual evidences of pressure resulting from a mass in the folds of the broad ligament which displaces the pelvic organs. A persistent pain following the acute attack may indicate localized peritonitis. H. C. Coe (Med. News, Apr. 21, 1900).

Shock referred to the abdomen occurring in woman capable of pregnancy should invariably cause a suspicion of ectopic gestation, and, if the shock is pronounced, the abdomen should be opened. E. P. Davis (Amer. Jour. Med. Sciences, May, 1900).

In personal experience, based upon about fifty cases, it has usually been by exclusion that the diagnosis of ectopic gestation has been made. Women have been repeatedly operated upon who have given no history of amenorrhœa fol-

lowed by irregular bleeding. These women had usually given a history of the last menstrual flow having been markedly less than usual. This is a point which deserves to be kept in mind. Again, ectopic gestation may exist without associated uterine enlargement, and without enlargement of the lower uterine segment—the so-called Hegar sign of early uterine pregnancy. As a rule, colicky pains were found fairly constant as a symptom of ectopic gestation. An exploratory vaginal section is of very great value. It should be done in every case in which the clinical history in the least suggests the possibility of ectopic gestation. When precedent amenorrhœa is followed by bleeding, one can be sure that the pregnancy is not normal. If under anæsthesia examination shows an enlarged and congested tube, the indication for operation is stringent. E. H. Grandin (Medical Record, Jan. 5, 1901).

Concealed hæmorrhage, pain, and shock may demand immediate surgical assistance, and this will be the rule when the gestation-tumor has reached the size of a hen's egg or something larger. Even a smaller tumor upon the fimbriated extremity of the tube may rupture and cause these symptoms, the danger to life being very great, since the hæmorrhage is into the peritoneal cavity with no resisting tissues to check it. (This form of ectopic gestation has been termed tubal abortion by Bland Sutton.) If the rupture takes place into the space between the folds of the broad ligament, development of the foetus may continue to term, the uterine gestation continuing *pari passu* or ending in abortion. A number of cases have been recorded in which the ectopic foetus has been capsulated in the abdominal cavity and has become an inert mass, uterine gestation supervening once or oftener without apparent disturbance from this foreign body. This seems less remarkable, however, when

one realizes how frequently pregnancy is successfully accomplished in the presence of all sorts of pelvic and abdominal tumors.

Six hundred and twenty-six cases of ectopic gestation analyzed, the collective mortality of which exceeded 41 per cent. In a spontaneous course it reached a mortality of 68.8 per cent. The most common form of ectopic gestation is that of tubal pregnancy. Schauta (*Centralb. f. die med. Wissen.*, Oct. 31, '90).

Eighty-three ectopic pregnancies noted in eight thousand labors. The dangers or causes of death may be hæmorrhage, septicæmia, peritonitis, or perforation of important viscera by bone. Of these, hæmorrhage is the most frequent. Joseph Price (*Amer. Jour. of Obstet.*, Dec., '92).

In extra-uterine pregnancy the mortality in cases of pelvic hæmorrhage depends, first, upon the amount of blood lost and, secondly, upon the profundity of the shock. Death due to loss of blood alone is extremely rare. For some reasons the extravasations from a ruptured foetal sac are attended by a shock which is out of all proportion to the amount of blood lost. In such instances the patient suffers not only from the loss of blood, but also from the extensive wounding of the peritoneum: the so-called peritoneal shock. In fatal cases of this kind death takes place in the course of a few hours. Mortality in deliberate operations upon well-prepared patients in good condition, at the hands of an experienced operator, is very small, indeed; that of operations of urgency considerable. Early operation is always desirable in doubtful as well as in certain cases. M. H. Richardson (*Annals of Surg.*, Dec., '94).

Treatment.—The only remedy for the complication which is under consideration consists in the complete removal of the offending mass at the earliest possible moment after it has been discovered, and this may sometimes be done without interruption of the utero-gestation, especially if the tube and ovary on the uninvolved side are healthy and do

not require removal. If the appendages on both sides must be removed the diversion of so large a portion of the nutrient blood-supply of the uterus will almost inevitably result in the premature termination of the uterine gestation.

Electropuncture condemned in all cases. Under galvanism or faradism, early extra-uterine pregnancy can be checked in its growth, caused to disappear or shrivel up. A. Brothers (*Amer. Jour. of Obstet.*, Feb., '90).

[While treatment in the earlier months by electricity for the destruction of the foetus has been ably advocated by Lusk, Skene, and others, it has been as ably opposed by Baldy, Tait, and others; first, because of the difficulty in determining the diagnosis of extra-uterine pregnancy before rupture of the sac; second, from the danger of the suppuration of the foetal sac; third, because the means are in many cases ineffectual to bring about the results desired. E. E. MONTGOMERY, *Assoc. Ed.*, Annual, '91.]

Thirteen cases of vaginal section of extra-uterine pregnancy, with good results. Cases suitable for this mode of treatment are those that rupture in the early months. Vaginal puncture and drainage are not suitable in an unruptured extra-uterine pregnancy. Most suitable cases are those in which a succession of ruptures has occurred. H. Kelly and F. Henrotin (*Amer. Gyn. and Obst. Jour.*, Aug., '96).

In every case of extra-uterine pregnancy where the foetus lives after the rupture it is owed to its being protected by an unruptured amniotic sac.

Primary rupture in 99 per cent. of all cases, even in those which go to term, is into the peritoneal cavity, and not into the cavity of the broad ligament. This statement rests on examination of over 200 cases. The most dangerous variety is the interstitial. In any form of tubal pregnancy operation should be performed as soon as the diagnosis is made. Before sixth month the placenta is generally easily removed, but from the seventh month on with a living child its removal is generally impossible. In such a case the placenta must be cleaned,

the cord cut, and the abdomen closed, or the abdomen can be left open and the placental surface packed with gauze until the placenta comes away. Mordecai Price (Univ. Med. Mag., July, '98).

In cases of unruptured ectopic gestation the vaginal operation, if congenial to the surgeon, may be elected. In non-active cases of encysted hæmatocele vaginal section and drainage constitute the operation of choice. Situation of mass low down, and the broad, roomy vaginæ of parous women are favorable to lower route. Before evacuating ectopic collections through vagina preparation for abdominal section should be made. In cases of free or uncontrollable hæmorrhage, after removing products of ectopic gestation vaginally, the abdomen should be opened at once. Vaginal operation in appropriate cases is attended with less mortality. W. D. Haggard, Jr. (Amer. Gyn. and Obst. Jour., July, '98).

Conclusions regarding extra-uterine pregnancy are:—

1. Extra-uterine pregnancy is more frequent than is generally believed.

2. When left to Nature's resources, the mortality is very high, the patient dying from primary hæmorrhage, or, secondarily, from sepsis and peritonitis.

3. The diagnosis is usually easy after the rupture takes place.

4. The surgical mortality, in skilled hands, when done in time, is very low.

5. No case of ruptured tubal pregnancy is out of danger until after a good ligature has secured the bleeding-points.

6. The abdominal route is the best and safest manner of approach in these cases.

7. Most cases should be irrigated properly and drained after removing the diseased tube and liberating all adhesions. Cordier (Annals of Gyn. and Pæd.; Amer. Medico-Surg. Bull., July 10, '98).

Treatment of ectopic pregnancy is by immediate operation as soon as diagnosis is made.

In cases left without operation all the children and 76 per cent. (Martin) of the mothers die. By early operation the mortality should not be over from 6 to 8 per cent. (Kelly). If the child is viable, an operation should be performed

at once; if nearly so, operation should be delayed until the child is viable. If the child has just died it is better to wait a few weeks, unless the symptoms are urgent, as the circulation in the placenta will then stop and it will become loosened, thus lessening danger of hæmorrhage and making the removal much easier. Pond (Med. Rec., Dec. 24, '98).

Treatment of tubal pregnancy by vaginal route is not only possible, but advisable under the following conditions: In case of absolutely certain diagnosis, provided the pregnancy has not gone on for more than two months; the pelvic measurements should be normal and the vagina and pelvic floor elastic; the uterine ligaments should be of normal elasticity; the operator should be familiar with the technique of vaginal operations. Becker (Centralb. f. Gyn., Jan. 14, '99).

In early ectopic gestation, if the sac of the ovum has not been ruptured, the entire ovum should be extirpated as soon as possible. If the sac ruptures into the abdominal cavity, and hæmatocele does not form, abdominal section should be done at once.

When, nevertheless, hæmatocele has formed and is distinctly limited, operation should be undertaken for positive and complicating indications only.

In cases of tubal abortion, either with or without hæmatocele, and where a dead ovum is retained in the tube, there is no stringent call for interference, but patient should be kept under observation. Veit (Zeit. f. Geburts. u. Gyn., B. 60, H. 1, '99).

Fifteen cases of extra-uterine pregnancy with a living child. Seven of these were operated on previous to viability, the remaining 8 on the thirty-fifth, thirty-sixth, fortieth, and forty-eighth weeks of pregnancy. Of those, 3 of the children died at periods varying from a few hours to (in one case) three weeks after operation. The 4 which survived were fully developed. Although the writer recommends deferring operation till near the end of pregnancy, he emphasizes the danger of postponing till the actual onset of pains, on account of the danger of rupture of the sac. In one case reported, a com-

mencing rupture was noted at the time of operation. Sittner (Centralbl. f. Gynäk., No. 2, 1903).

Pruritus Vulvæ.

This is one of the most annoying troubles of the pregnant state, and occurs alike in primiparæ and multiparæ. It consists in an intense and intolerable itching of the skin of the labia and circumanal region and sometimes the mucous membrane of the vagina, and is especially annoying at night after the patient has retired to her bed. The rubbing and scratching which are provoked induce excoriation and sometimes severe inflammation of the skin, often lead to the formation of the masturbation habit, and may make the patient's life truly miserable. There may be very little external evidence of disturbance, or the skin may show cracks and abrasions. It is sometimes dry, red, and parchment-like; in other cases it is moist, with transuded serum, and the entire vulva may be swollen, hot, and painful to the touch.

There are three principal causes, according to my observation: 1. Discharges from the vagina or cervical canal 2. Parasites of the skin. 3. Irritation of cutaneous nerve-endings of central origin.

Discharges from the vagina or cervical canal. The turgid, congested condition of the vagina and uterus during pregnancy conduces to the hypersecretion of glandular fluid and the transudation of serum from the vessels. This discharge may be bland and unirritating or it may be acrid and corrosive. Want of cleanliness and possibly the action of the bacteria of the skin favor the development of the troublesome condition. The discharge may be white and watery, or colorless and slimy, and it may be scanty or abundant.

TREATMENT.—The measures I have found efficacious consist in drying the skin and mucous membrane with absorbent cotton, tamponing the vagina with cotton-wool soaked with a paste of glycerin and subnitrate of bismuth, and covering the skin with a thick layer of the same. This should be repeated daily and will usually bring relief.

As to skin parasites, these are the ordinary *Pediculi pubis*, which adhere tenaciously to the roots of the hair of the vulva. Mercurial ointment rubbed into the skin a few days in succession will destroy them.

As regards irritation of cutaneous nerve-endings of central origin the cutaneous nerves are irritated, in all these conditions, but in this variety the source of the trouble is not local.

Diabetes may produce this condition, though the irritant, in some cases at least, is the urine, which has been allowed to soil the skin. The treatment will consist, first, as in all cases, of cleanliness, then the application of the glycerin-and-bismuth paste or of vaselin or zinc ointment with which a sufficient quantity of cocaine or carbolic acid (15 grains to the ounce will usually suffice) has been combined. The causative disease must, of course, receive proper treatment at the same time.

Ichthyol is rationally and logically indicated in all cases of vulvar pruritus, used either as a 10-per-cent. ointment, plaster, or lotion (aqueous). Doizy (Bull. Méd., xii, p. 904, '98).

Œdema.

Œdema of the external genitals, the lower and upper extremities, may properly be considered together, for it in all cases results from the same cause,—namely: interference with the venous circulation,—the first being more frequent than the other two.

Œdema of the vulva is very common,

the tissue becoming quite dark, sometimes almost black. The veins may be greatly enlarged and the swelling of the tissues so extensive as to be painful and make locomotion difficult. The treatment consists in the application of cooling and astringent lotions—*e.g.*, the lead-and-opium wash—and rest in bed the greater portion of the time. This and the other two conditions are accompaniments of the later months of pregnancy when the weight and pressure of the heavy womb impair the freedom of circulation of the blood-current. Œdema of the lower extremities is especially apt to occur with those who suffer with varicose veins of the legs, with cooks and washerwomen, and others whose duties compel them to be standing from morning until night.

TREATMENT.—This is the same as for œdema of the vulva, rest in the horizontal position being all-important. Bandaging the feet and legs, the bandage being carried well above the knees, will often give comfort and enable the patient to go about in the pursuit of her ordinary duties.

Œdema of the upper extremities I have never seen. It would indicate a very bad condition of the circulation and a probable lesion of the heart. In addition to appropriate treatment of the central cause, rest in bed is imperative, and the limbs should be lightly bandaged from hand to shoulder if the swelling is considerable.

Hæmorrhoids.

This condition is often a source of great annoyance, especially in the later months of pregnancy. It may be regarded as similar in its causation with œdema of the vulva, and, indeed, may accompany it. It is more frequent with those who have suffered with the same trouble prior to pregnancy than with

others, it is common with those who suffer with constipation, and is a source of great pain when the bowels are moved.

TREATMENT.—Surgical measures are only indicated when the hæmorrhoids are very large and pediculated or are the source of unusual pain and discomfort. Rest in bed and the use of astringent and sedative lotions, such as have already been mentioned, and the careful regulation of the bowels will usually bring relief. This may, however, only be temporary, the permanent relief being postponed until pregnancy has terminated and the pressure and congestion have disappeared. (See HÆMORRHOIDS, vol. iii.)

Uterine Pain.

This condition may be brought about in many ways: *e.g.*, by a rigid and unyielding condition of the tissues of the organ, the pressure of contiguous viscera, emotions of various kinds, the movements of the foetus, traumatism from without, etc. The pain may be sharp or prolonged and aching, and is due to the contraction of the muscular fibres of the uterus. It may recur at frequent intervals, and if it should continue for a period of several hours it would result in the emptying of the organ.

TREATMENT.—Rest, the horizontal position, and an occasional hypodermic of morphine (morphine sulphate, $\frac{1}{8}$ grain; atropine sulphate, $\frac{1}{120}$ grain), given only when pain is severe, may be used for its relief. The pain may be so evanescent that no treatment will be required other than the avoidance of its cause, if that can be discovered.

Spurious Pregnancy.

This can hardly be considered a *disorder* of pregnancy, but it deserves consideration especially since the physician should always be on his guard to distinguish it from the *real* condition. Many ludicrous examples of spurious or sup-

posed pregnancy have been recorded, among them that of Queen Mary, of England, who repeatedly set the day for her *accouchement* only to disappoint as frequently her dissatisfied and, it is said, disgusted, lord, Phillip II, of Spain. Spurious pregnancy originates generally in a desire to become pregnant, which may become an intense yearning. The condition depends principally upon the presence of an abdominal tumor which may undergo enlargement suggestive of the enlargement of the gravid womb. Symptoms of true pregnancy are also sometimes present, including the "morning sickness" and the violet discoloration of the mucous membrane of the vagina, which is due to impaired or disturbed circulation the same as in utero-gestation.

The tumor may be uterine or extra-uterine, ectopic pregnancy being excluded. Of the extra-uterine tumors the simplest form is due to the presence of gas in the bowels. Strange as it may seem, this may persist for weeks and delude the patient completely. This "phantom tumor" is not uncommon and its sudden collapse is likely to cause the greatest surprise, if not disappointment. The other simulative form of extra-uterine tumor consists in the various types of cysts or solid growths, especially those of the ovary. These tumors sometimes grow very rapidly, this being especially true of the malignant tumors of the abdomen. In the early days of ovariectomy unmarried women were repeatedly accused of pregnancy when suffering with ovarian cysts. Not infrequently an ovarian or other form of abdominal tumor develops coincidently with utero-gestation.

The tumors of the uterus which simulate pregnancy are principally of two forms: those which are due to the pres-

ence of fluid and those which are due to the presence of gas. Rarer forms are the hydatid tumors, and the so-called molar pregnancy, or hydatidiform mole. Solid tumors (fibroids) of the uterus develop so slowly that they are seldom mistaken for pregnancy, though the contour of the fibroid uterus is often very suggestive of gestation. Molar pregnancy is, in reality, a myxomatous tumor due to proliferative degeneration of chorionic villi. It is formed usually in the first, but not later than the third, month of pregnancy. Beginning as a true pregnancy, the foetus dies early in its history and is absorbed. Cysts of varying size, from a small seed to a walnut, filled with a mucous fluid, are formed in great numbers and are occasionally detached. Abortion may occur prior to the sixth month or the condition may go to term or even longer and require surgical interference. Death from hæmorrhage is one of the dangers which is to be apprehended.

Hydatid tumor of the uterus is extremely rare. Lusk says that but one authentic case has been recorded. The diagnosis depends, of course, upon the actual presence of acephalocysts or their hooklets. The cystic tumors in molar pregnancy are suggestive of acephalocysts; hence the term hydatidiform mole.

The forms of simulated pregnancy in which the uterus is enlarged by a collection of fluid or gas are known as hydrometra (a collection of more or less watery fluid), pyometra (a collection of purulent fluid), hæmatometra (a collection of blood), and physometra (a collection of gas).

These are unusual conditions, and have received very little investigation, so far as I have been able to ascertain. Most of the works on obstetrics and gynecology are silent concerning them. They

must not be confused with those cases in which there is disease of the decidua, the amnion, or the placenta, and in which true, and not spurious, pregnancy is present. They are all conditions in which infection is probable. Just what its nature may be it is difficult to say.

The enlargement of the uterus from the retention of menstrual fluid might also be regarded as simulative of pregnancy and is not a very rare condition. It occurs principally in young unmarried women. In all these cases of uterine enlargement the indication is to empty the uterus and usually it will be proper to follow this procedure with irrigation and curettage. The latter operation must be performed with caution and discrimination, and in most cases a light tampon should be introduced into the organ and retained two or three days.

Concealed Pregnancy.

This condition requires only brief notice. It implies a situation which is marked by other more palpable and demonstrable conditions; especially by the various solid and fluid tumors of the pelvis and abdomen. These tumors exist and may have been discovered prior to the pregnancy. With cystic tumors, pregnancy may occur and perhaps continue to term, but the latter may not be discovered until it is far advanced. With solid tumors, especially those which involve the structure of the uterus, the resistance is greater and pregnancy is usually interrupted or at least interfered with before it has progressed very far. In some cases delivery at term becomes impossible by the ordinary channel, and an abortion must be induced, the tumor must be removed, or else it may be necessary to remove the foetus through an abdominal incision. Concealed pregnancy may, therefore, be a most undesirable complication. Rarely pregnancy takes

place under normal conditions and the situation is not suspected until a late period. The menses appear at regular intervals, the abdomen does not show the usual symmetrical enlargement, and for various reasons the woman does not realize that pregnancy is present. Of course, the only treatment which is indicated is the expectant one, the pregnancy being allowed to continue without interference until the foetus is discharged at term.

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PROGRESSIVE MUSCULAR ATROPHY. See MUSCLES and SPINAL CORD.

PROLAPSE. See various organs subject to prolapse: UTERUS, VAGINA, RECTUM, etc.

PROSTATE GLAND. See URINARY SYSTEM, SURGICAL DISEASES OF.

PSEUDOLEUKÆMIA (HODGKIN'S DISEASE).

Definition.—This obscure disease may be defined as an hypertrophy of the lymphatic tissues, accompanied by an anæmia, but without leucocytosis. It resembles in many respects the granulomata, neoplastic proliferation, and true leukæmia. In the glands of many undoubted cases of Hodgkin's disease tubercle bacilli have been found; such is, however, not a constant condition. From the sarcomata it usually differs by virtue of its wide-spread implication of the lymphatic system; yet undoubted sarcoma may be almost universal. The local lesions are almost identical with those seen in leukæmia, and cases of apparent Hodgkin's disease have become converted into true leukæmia; yet the absence of leukæmic leucocytosis is usually one of the most striking features

of the disease. While we are at present only upon provisional ground, pathological analogy aids us in interpreting pseudoleukæmia as a peculiar infection, in which a noxa acts upon the lymphatic tissues and stimulates them to excessive proliferation. Of the nature of the infection we are entirely ignorant. We do not know the portal of infection, but from the fact that the disease so often begins in the cervical glands, it has been supposed to be through the mouth and throat. It may occur at any age, usually during young adult life.

Symptoms.—Instances of acute pseudoleukæmia have been described, with fever, hæmorrhages, glandular enlargements, marked toxæmia, and an early death. While some such have been authentic and well verified, in a majority of instances acute leukæmia, sepsis, and the purpuræ have not been excluded.

The disease is usually chronic, and the symptoms may be grouped as toxic or mechanical. In some cases the toxic symptoms precede all others, but usually the glandular enlargements are the first signs. The cervical glands are commonly the ones first involved, but some one or several of the other groups soon become implicated. There is more or less pain connected with the swelling, and the glands may be tender to the touch. The cervical enlargement alters the appearance of the patient, and produces quite a characteristic facies. The axillary enlargements cause the patient to hold the arms away from the chest; they may press upon the nerve-trunks and cause intense pain, or may produce a destructive neuritis, with all of its symptoms; they may obstruct the flow of blood in the axillary veins and thus produce extreme cyanosis and œdema of the arm. The enlargement of the inguinal glands induces a peculiar attitude

on standing, and the subjects walk with circumspection; pressure symptoms are not uncommon.

The general symptoms are those of weakness, malaise, and asthenia; the patient loses flesh, fever is often present, and regular or irregular sweats may occur. The skin is usually a pale, sallow color; it may exhibit petechiæ and œdema. Bronzing has been observed. Accidental eruptions are common.

In case of leukæmia under observation for 3½ months, there was a daily rise of temperature followed by a gradual fall during the whole period. Von Hajek (Wiener klin. Woch., May 20, '97).

Stress laid upon the resemblance which Hodgkin's disease and lymphatic leukæmia bear to one another. So far as symptoms are concerned the differential diagnosis cannot be made, for glandular swellings characterize both and the anæmia may be equally marked. The only important difference lies in the blood-constituents, and upon this the diagnosis rests. In lymphatic leukæmia there is a marked increase in the lymphocytes, while in Hodgkin's disease their relative and absolute number remains about normal. M. Einhorn (Medical Record, July 12, 1902).

Symptoms involving the respiratory tract are frequent and important. The nares may be closed by the lymphatic overgrowth. The laryngeal growths may modify or abolish the voice or produce obstruction. The trachea may be pushed far to one side and deeply buried beneath the mass of enlarged cervical glands; it may be seriously and fatally stenosed. Pressure upon a bronchus or a portion of the lung may produce collapse of the lung-tissue, with subsequent pneumonia, abscess, or gangrene. Dyspnoea of several types occurs; it may be hæmic, cardiac, due to pressure upon some part of the respiratory tract, or rarely to pleural effusion due to pressure upon the azygos vein. The laryngeal

nerves may be pressed upon, as may the vagus, with their corresponding symptoms. Hæmoptysis is uncommon; epistaxis not infrequent.

Circulatory symptoms consist of rapid cardiac action, hæmic basal or apical murmurs, the murmurs and pulsation in the jugular veins, nutritional disturbances due to pressure upon vascular trunks, and peripheral or central hæmorrhages. Endocarditis and pericarditis are rare. The mediastinal growths may displace the heart and seriously disturb its action.

The alimentary symptoms are important. Stomatitis and pharyngitis are not rare, while dyspeptic symptoms are common. Crises of pain are probably the result of nerve-pressure. Dysphagia may be produced by pressure. The liver may be enlarged, and the enlarged glands at the hilum, which may be palpable, may cause, by pressure, ascites or jaundice. Constipation is the rule; diarrhœa should excite suspicion of intestinal ulceration. Hæmatemesis and melæna are uncommon. The retroperitoneal glands may be palpable, as may the nodules in the intestinal tract.

Other symptoms are irregular. Albuminuria is uncommon, but amyloid disease may induce it. Casts may be present. The urine seems to be nearly normal. In particular the uric acid and the purin bases are usually not increased. Disturbances in urination are rare. Pains in the bones are sometimes complained of. The menstrual function is usually disturbed, but sterility does not follow in either sex. Insomnia, vertigo, and headaches are common. The local nervous symptoms are those of pressure: pains, paræsthesia, anæsthesia, paralysis, and trophic changes.

The condition of the blood is that of a simple anæmia. There is a moderate

oligocythæmia and a slightly disproportionate oligochromæmia. Poikilocytosis is usually moderate, and nucleated red cells are not frequent. The leucocytes are usually quite normal, both as to quality and quantity. Some cases exhibit a simple polymorphonuclear leucocytosis, particularly during the last stages; in a few cases the eosinophilic cells are increased, while in other cases a lymphocytosis may be present.

Remissions and exacerbations are of frequent occurrence. The glands may decrease in size and then may increase, and with these alternations the symptoms, particularly the fever, fluctuate. The duration of the disease is from six months to several years. The disease is nearly always fatal.

Diagnosis.—In adults it must be diagnosed from the granulomata, sarcomata, and leukæmia. As against sarcoma, the extent of the implication, the rapidity of the process, the leucocytosis, and the cachexia will usually permit of a diagnosis. Ordinary lymph-tuberculosis is localized, and sooner or later the glands break down; there are, however, instances of wide-spread lymph-tuberculosis in which no caseation occurs, and such can be with difficulty separated from pseudoleukæmia. In children rickets, syphilis, amyloid disease, chronic gastro-enteritis, or any of the secondary anæmiæ which produce splenic enlargement must be excluded.

Pathology.—In pseudoleukæmia the implication of the lymphatic tissues is wide-spread. It is never confined to one set of glands, nor has it ever been shown to have been confined to the spleen or to the bone-marrow. The glands may become enlarged singly or in chains. The capsule is usually thickened, and the growth does not tend to break through it. Early in the disease the glands are

soft, later they may become hard. They may be gray in color, may have a chloromatous hue, may be deeply pigmented, or may be hæmorrhagic. Softening and necrosis are not common, and the surrounding tissues are rarely adherent to the glands.

Microscopically there is a marked hyperplasia of the lymphatic cells. While these are of the common lymphatic type, there is a noteworthy polymorphism in the cells. There are also present fibroblasts, large endothelial cells, and globuliferous giant cells. The walls of the blood-vessels are not implicated. The typical arrangement of the germ-centres is entirely distorted, but there is no predominance of the mother-cells, such as is seen in the glands in acute leukæmia, the condition resembling more those exhibited in chronic lymphæmia. Cellular degenerations are frequent, while mitoses bespeak the rapid proliferation.

Autopsy of a case of pseudoleukæmia with cutaneous involvement, in which the lesions in the skin resembled lymphosarcoma. Kirkoroff (*Russki Archiv Patol.*, etc., March, 1901).

Case of acute lymphatic pseudoleukæmia in which repeated examinations of the sputum were made during life and of the fluids after death. No tuberculous lesions were discoverable; on the other hand, the microscopical examination of the lymph-nodes showed the characteristics peculiar to lymphosarcoma. J. L. Heffron (*Amer. Medicine*, April 12, 1902).

The cervical, axillary, inguinal, mediastinal and retroperitoneal glands are most heavily involved. The faucial and pharyngeal tonsils are often affected. Adventitious lymph-nodules may appear in the skin, in the nares, in the larynx and the bronchi, in the liver, kidneys, adrenal bodies, ovaries, and

testicles, while the follicles within the alimentary tract may be much enlarged. The spleen is usually enlarged to a moderate degree. It is commonly hard, is often mottled, and may present distinct tumors. The bone-marrow is often splenified: a condition not at all specific, but seen in many extreme anæmiæ. Sometimes there is a lymphatic overgrowth. The periosteum may exhibit infiltration. The central nervous system is rarely implicated, as are the mammæ, the organs of special sense, the salivary glands, and thyroid body; in young subjects the thymus is often enlarged.

The general tissues often exhibit a marked degree of fatty degeneration. Amyloid change has been described. There is usually marked wasting of the tissues.

Hodgkin's disease is in all probability a lymphatic tuberculosis. Fever, recurrent in type, occurs commonly in this affection of the glandular structures. So-called "recurrent fever" is a symptom, not a disease. In a few rare instances the clinical diagnosis, when such fever prevailed, was malignant lymphoma (Pel), sarcoma (Volckers), myelosarcoma (Hammer), and lymphosarcoma (Remus and Witthower, Seeborn). Ehrlich and Lazarus believe that Hodgkin's disease is a lymphosarcoma, and that the tuberculous process is accidental. Sternberg, on the other hand, has pointed out the differences, and insists strongly upon the tuberculosis as the process giving rise to the adenitis of Hodgkin's disease. He believes that the symptoms are different from those of other forms of tuberculosis, the anatomy of the gland having much to do with the process. J. H. Musser (*Amer. Medicine*, Jan. 4, 1902).

Treatment.—Large doses of arsenic seem to check the lymphatic enlargements, improve the anæmia, and better the general health. The best of hygiene

and food, together with tonics, is very important. Mercury, iodine, salicylic acid, ichthyol, and green soap may be applied to the skin over the enlarged glands; while they may alleviate the pain and retard the enlargement, they do not check it. The same is true of electricity. Surgical interference is often necessary for the relief of pressure symptoms, particularly tracheotomy, which is here especially difficult. Pseudoleukæmics bear operation fairly well. It is not probable that excision of the glands or of the spleen can in any way modify or check the disease.

Case of pseudoleukæmia (Hodgkin's disease) cured by subcutaneous injections of arsenic.

In all 100 injections of Fowler's solution were given. The initial dose was $1\frac{1}{2}$ minims diluted one-half with distilled water. At the beginning the dose was increased $\frac{3}{4}$ minim every third day, until 1 Pravaz syringeful (15 minims) of pure Fowler's solution daily was reached. The diminishing doses were given during a period of four weeks, when injections were suspended, and the case discharged as cured. Moritz Katzenstein (Deutsch. Arch. f. klin. Med., lvi, Nos. 1 and 2, pp. 121-124, '95).

The writer treated two patients with the x-rays with very satisfactory results. A medium vacuum tube was employed, and exposures were made daily for the first ten days, various affected glands being subjected to the rays for one minute only. After 34 applications of the x-rays all the enlarged glands had almost entirely disappeared, and the general condition of the patient was much improved; when discharged no glands were palpable. The blood in this patient, however, did not show any characteristic changes. The second patient showed universal enlargement of the lymphatic glands. The blood-examination revealed a well-marked anæmia and a leucocytosis of 208,000, the increase being most marked in the lymphocytes (78.75 per cent.). This patient

was also treated with the x-rays, and after fifteen exposures he developed slight toxæmia, and the treatment therefore was discontinued. However, the general condition of the patient was much improved, and all palpable glands were diminished in size, the number of leucocytes being reduced to 76,000. The treatment was again renewed and steady improvement occurred, ending in cure. N. Senn (New York Med. Jour., April 18, 1903).

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PSORIASIS.

Definition.—Psoriasis is a cutaneous disease characterized by the presence of silvery-white perfectly-dry scales, which overlie a reddish, shining base.

Symptoms.—The eruption of psoriasis is always dry and scaly. It begins in one or more red points, which quickly become covered with white, silvery scales. These may be readily scratched off by the finger-nail, and when this is done a bleeding surface is exposed. When many of these small, scaly lesions are present, the eruption is described as *punctate psoriasis*, and this form of the eruption is comparatively more frequent in children than in adults; when the scaly lesions increase in size and appear like drops of grease or thin mortar spattered over the skin, we have the *guttate form* of the disease; and when the patches assume the size and shape of silver coins they are often described as *nummular psoriasis*. By healing in the centre these lesions may be converted into scaly rings, or by peripheral increase and coalescence they may result in the formation of extensive scaly patches. Though the disease is not uncommonly met in children, diffused or general psoriasis is rarely met with among them. It is not generally so well

developed and so extensive as it is apt to be in later years. The amount of scaliness present in any case depends upon the attention which the patient naturally devotes to his skin. As the eruption tends to disappear, the scaling grows less, often disappearing from the centre of the patch and leaving a marginate ring. Finally the redness fades and the skin assumes a normal appearance, except in certain cases, where pigmentation may occur. In rare cases of psoriasis the eruption may tend to rapidly involve the whole skin. The cutaneous congestion is severe, and large flakes of partly-detached epidermis may take the place of the silvery scales.

Psoriasis is usually seen upon the extensor surface of the extremities, and is especially apt to be noted about the elbows and knees. When upon the scalp the scaly patches are apt to be small, numerous, and circular, with healthy skin intervening. The eruption upon one extremity or on one side of the trunk is usually duplicated upon the other side (George Henry Fox).

Pruritus may or may not be complained of, and the patients may be in apparently good health. Disorders of the muscles and joints are often noted, however.

Diagnosis.—Diagnosis of psoriasis, as a rule, presents no difficulties; the silvery-white, perfectly-dry scales are altogether characteristic. Upon the scalp it may be confounded with seborrhœa, but the absence of inflammatory reddening and the greasy character of the scales in the latter affection will serve to distinguish it from the former. (Hartzell.)

ECZEMA.—Whether occurring in small disks or in large, irregular patches, the border in psoriasis is always sharply defined, and never shades off gradually into the surrounding healthy skin, as does

the ordinary patch of eczema. This is a diagnostic point of great importance. In many cases of eczema the patches may be dry and scaly and present a resemblance to those of psoriasis, but the rounded, silvery disks or larger marginate patches of the latter disease are usually so characteristic that an error in diagnosis is not likely to be made. While eczema may appear upon almost any part of the body, and often exhibits a tendency to attack the flexor aspect of the joints and other parts where the skin is thin and delicate, psoriasis, as stated, is generally seen upon the extensor surface of the extremities, and is especially apt to be noted about the elbows and knees. (George Henry Fox.)

SYPHILIS.—An eruption resembling psoriasis sometimes occurs in this disease, but the successive crops and the coalescence of lesions in psoriasis serve to distinguish it. (Cantrell.)

Etiology.—Psoriasis occurs somewhat more frequently in males than in females, and at all ages, but it is most frequently met with in subjects between 10 and 30 years of age, though it is by no means rare in infancy. It is essentially a chronic disease. Psoriasis is not a local disorder, but depends upon a general condition, which repeatedly produces the eruption.

Psoriasis is dependent upon a blood-state closely allied to that belonging to gout and rheumatism: the uric-acid diathesis. Free indulgence in meat tends greatly to aggravate the eruption, whereas its restriction, especially the avoidance of beef and mutton, including meat-extracts and strong soups, materially aids in its removal. (L. Duncan Bulkley.)

Psoriasis of the palm is occasionally met with in cases of acquired syphilis, but usually this is observed, according to

Hutchinson, in individuals whose hands are more or less irritated by friction.

Tendency to psoriasis is frequently inherited, and often the disease may be observed in two or more generations.

Seasons seem to have some influence upon the disease, since in spring and autumn the disease often takes on an increased vigor. Influences tending to lower the vitality seem also to play a part. Pregnancy and lactation are frequent causes of its extension; it frequently follows scarlet fever. If psoriasis already exists the latter disease may cause extension of the eruption.

The pathological lesion consists in an hypertrophy of the upper cutaneous layers, characterized by keratosis. The examination of 1500 sections taken from six untreated cases have led Munro (*Annales de Dermat. et de Syph.*, No. 11, '98) to conclude that the disease is not due, as hitherto supposed, to some vice of formation of the corneous epidermis, the abnormal keratinization being an essentially secondary lesion. The primitive lesions of psoriasis are miliary abscesses of the epidermis, situated almost upon the surface of the corneous layer, and around these miliary abscesses the epidermic reaction produces an hyperkeratosis. No specific micro-organism was found. The disease is not contagious.

In spite of recent researches on the etiology of psoriasis, we do not know its true nature, but only a certain number of predisposing causes. Psoriasis is often hereditary. Patients frequently show signs of "arthritis." It is more common in the male sex, and is often seen in vigorous subjects. The disease affects chiefly the parts of the skin irritated by contact with clothes, or by some traumatism in the knees, elbows, shoulders, etc. It may occur after vaccination. Sometimes it follows excesses in eating or drinking. In women it may occur at the menstrual periods or at the menopause. In fact, all circumstances

leading to temporary or permanent depression favor the eruption of psoriasis. Balzer (*Revue de Thérap.*, May 15, 1902).

Treatment.—The local treatment is of secondary importance, the disease being a manifestation of a general disorder. If a gouty diathesis be traceable, appropriate remedies are indicated (see GOUT). If the nervous system be at fault, remedies tending to increase their nutrition,—strychnine, for instance,—assisted by electricity, especially the static, are indicated. In other words, the general causative factor should be ascertained and appropriately treated. L. D. Bulkley has emphasized the fact that psoriasis is benefited by alkaline remedies, counteracting acidity of the blood and urine.

Jonathan Hutchinson states that in all cases of psoriasis alcoholic stimulants should be forbidden, and that those who persist in intemperance are incurable. He recommends an ointment containing chrysophanic acid, creasote, liquor carbonis, and ammonio-chloride of mercury, varying in proportion according to the delicacy of the skin; this must be used very freely, without regard to the underclothing or bed-linen. The regular use of a hot bath softens the skin and prepares it to receive the ointment.

Arsenic enjoys the confidence of some dermatologists, but, according to Fox, Crocker, and other authorities, it is not only useless, but in some cases it may be injurious. It fails entirely as a prophylactic, and usually local applications are preferable to its use. When the disease tends to improve, however, it may be of service in hastening recovery.

Of the various local remedies employed chrysarobin stands without a rival. Like arsenic, it is most likely to do good when the acute congestion of the psoriatic patches has subsided and the eruption is tending toward a spontaneous improvement. It not only stains the

skin temporarily, but it permanently discolors the underclothing and the bed-linen, if due precaution is not taken. When rubbed in where the skin is thin, or near it, it often excites a very unpleasant dermatitis for a few days; and when by chance a little of the ointment gets into the eye a very severe conjunctivitis often results. Upon the trunk and extremities a 5- or 10-per-cent. ointment, made by rubbing up a finely-sifted chrysarobin in vaselin, can be advantageously used; but upon the scalp and face the ointment of ammoniated mercury will generally prove efficacious, and is to be preferred to the chrysarobin. George H. Fox (*Amer. Jour. Obstet.*, Apr., '96).

Intravenous injections of arsenic employed in 28 cases of psoriasis, in 25 of which no other treatment was adopted. Of these 25, 10 were completely cured, 6 left the hospital much relieved, and 9 were reported as still under treatment, all greatly improved, and 3 nearly cured. The commencing dose is 1 milligramme of arsenous acid, and this is increased daily by 1 milligramme up to 15 milligrammes, the maximum dose, which is repeated daily until the eruption disappears, generally at the end of six or seven weeks. The following is method of procedure:—

After disinfection of the skin by soap, turpentine, ether, and sublimate, and the application of an Esmarch bandage above the elbow to render the veins prominent, the needle of a Pravaz syringe is introduced as nearly parallel to the skin as possible, and its penetration of the vein ascertained by withdrawing the piston. After the injection of 1 cubic centimetre of a limpid solution of arsenic of the desired strength, the wound is closed with oxide-of-zinc plaster. Herxheimer (*La Sem. Méd.*, '97; *Brit. Med. Jour.*, Oct. 23, '97).

Strong alcohol applied at night to the affected part by means of cotton compresses are very effective. The alcohol used varied from 70 to 90 per cent., and contained 2 per cent. of salicylic acid. A rubber dam or some other impervious material should be used to prevent evaporation, and the compress left until the

following morning, when the parts are washed with soap, and the loosened scales removed. The part is then anointed with lanolin. This method of treatment, besides being effective, is cleanly, and gives the patient no annoyance. Lau (*Jour. de Méd. de Paris*, Nov. 19, '99).

Psoriasis is not very amenable to treatment. Arsenic is, on the whole, the most efficacious drug, but it has to be given in large doses and with great perseverance. When it cures the disease it often leaves pigmentations of the skin, sometimes thickening of the epidermis of the palms and soles, and in very rare cases, according to Hutchinson, corn-like growths which may become malignant. In acute forms antimony is most useful, and nerve-sedatives should be administered if there is any clear indication for their employment. Thyroid feeding has been found quite useless. For local application, parasiticide substances, such as mercurial preparations, resorcin, etc., are useful, but the most efficient of all is chrysarobin. A visit to a sulphur spring will in many cases complete the cure. Whatever plan of treatment is employed, it must be followed out perseveringly. Malcolm Morris (*New York Med. Jour.*, Nov. 16, 1901).

The writer emphasizes the great therapeutic value of his combination of green soap and chrysarobin for the treatment of psoriasis. The salve is rubbed into the patch with a paint brush, morning and evening, for four to six days. The fifth and sixth days the patch is laved with warm water and vaselin and thoroughly rubbed in, once to three times a day. This should be repeated for one to three days, and then the salve recommenced, going over the same eight-day course from one to three times. The author's formula is: 10 parts salicylic acid, 20 parts each of chrysarobin and oleum rusci, 25 parts each of green soap and vaselin. The salve thus made combines keratolytic, reducing, peeling and specific anti-psoriasis remedies. Dreuw (*Münchener medicinische Wochenschrift*, vol. li, No. 20, 1904).

The use of thyroid tabloids in psoriasis has been disappointing; nevertheless,

great improvement has been noted in certain cases. (See ANIMAL EXTRACTS, volume i.)

As to the prognosis, George Henry Fox states that it is often an easy matter to remove the eruption by treatment, but it is difficult, if not impossible, in many cases, to prevent its speedy return. The prognosis, therefore, is always unfavorable as regards the permanent cure of the disease.

PTOSIS. See PALPEBRÆ.

PUERPERAL ECLAMPSIA AND FEVER. See ECLAMPSIA.

PULMONARY ABSCESS AND GANGRENE.

Pulmonary Abscess.

Although abscess of the lung is almost always associated with pulmonary tuberculosis, it may also be the result of other local or neighboring pathological processes and injuries. Hence its consideration here.

Mechanical injuries, such as fractured ribs and penetrating wounds, may cause abscess of the lung, especially in cases in which the vitality is below normal. This variety, however, will be considered under THORAX ORGANS, INJURIES OF.

Symptoms.—When, in the course of pyæmia or any other infectious disease in which the lungs are not primarily involved, localized distress in one or both lungs, shortness of breath, etc., and a rise in temperature appear, abscess of the lung is a possibility. It can only be verified, however, by the presence of pus in the sputa. These are usually yellowish green and emit an offensive odor, though less so than in gangrene. At times they assume a reddish or brownish tinge and contain shreds of tissue which, microscopically examined, often prove to be elastic fibres. Blood-corpuscles, alveolar

epithelium, crystals of margaric acid, cholesterol mold-fungi, and various bacteria, according to the causative malady, may also be found in the secretions.

In abscess occurring as complication of acute pneumonia there is an intermittent rise in the temperature, usually about the time of the crisis; and marked prostration appears. At first physical examination affords but little information, though the signs of consolidation persist. When an abscess of large size opens into the bronchi, however, the signs of a cavity as witnessed in tuberculosis present themselves. The history of the case and the presence of the cavity afford opportunity for a certain diagnosis.

Simple abscess of the lungs is liable to be met with in one of four forms: The first is that in which the symptoms are very obscure from the beginning, and remain so until there suddenly occurs a discharge of purulent matter. In the second form the symptoms resemble those of pleurisy with effusion, and in the third those of pulmonary tuberculosis. The fourth is that associated with the variety of pneumonia which advances slowly from one lobule to another, or is characterized by a tendency to skip from one lung to the other. S. Seabury Jones (Med. News, Mar. 2, '89).

Local tenderness is an important sign of abscess of the lung. C. F. Withington (Boston Med. and Surg. Jour., Mar. 10, '98).

Etiology.—Acute pneumonia is the disease in the course of which pulmonary abscess most frequently occurs next to pulmonary tuberculosis, but, at best, even here it is not a frequent complication. Septicæmia or pyæmia may also be accompanied by abscess of the lung through infectious emboli. It is especially liable to occur in persons in whom the general health had been poor before the onset of the causative affection, and in lymphatic or alcoholic subjects.

In some forms of broncho-pneumonia it is said to be frequently observed. It occasionally presents itself as a complication of abscesses in neighboring structures, the liver particularly, the pleural cavity, and of tumors and cysts.

Pathology.—The local lesions are merely those of an ordinary abscess, containing micro-organisms, these varying, as stated, with the nature of the causative disease. Streptococci and the diplococcus pneumoniae among others have been observed. The size of the abscess may vary greatly from that of a chestnut to that of a large orange. An abscess of long duration shows a limiting peripheral membrane, and closed abscesses considerable cicatricial tissue: a clear indication of the tendency to resolution of these abscesses if the general health can be improved.

Pulmonary abscesses may rupture into the pleura, the pericardium, and peritoneum.

Prognosis.—The prognosis of pulmonary abscess other than that due to tuberculosis has somewhat improved since paracentesis has been introduced. In abscess complicating pneumonia the prognosis is not as unfavorable as would logically appear. The prognosis becomes very unfavorable, however, when pulmonary abscess occurs as complications of abscesses elsewhere.

The prognosis in abscess of the lung depends largely on the nature of the perforation through which the pus finds its way into the bronchus, to be expectorated. A large opening corresponds to free drainage and an acute course, while in cases in which the orifice is small the discharge takes place slowly, and the course accordingly becomes chronic and the outlook more unfavorable. Serous or purulent exudation into the pleura does not necessarily increase the gravity of the situation, but metastatic abscesses, especially in the brain, are always seri-

ous complications. Jacobson (*Zeits. f. klin. Med.*, vol. xl, Nos. 3 and 4, 1900).

A natural cure of abscess of the lung may be expected in young persons, in small foci of pus at the apex, and in larger foci at the base of the lung, provided that the cases are recent. Therefore expectant treatment may be followed in such cases, individualizing in each case, however. If a spontaneous opening does not soon appear, and if it appears, if the symptoms do not soon disappear, or if it is evident that the abscess is not emptying itself, operative intervention is urgently demanded. The earlier the operation is performed, the more perfect is the result, and the less the opportunity for small foci to extend. Karewski (*Münch. med. Wochens.*, Oct. 6, 1903).

Treatment.—In cases other than tuberculous ones, the abscess, when the diagnosis is certain, should be evacuated by aspiration or incision. It will not only tend to prevent rupture into the neighboring cavities, but counteract the tendency to mortal marasmus which an untreated abscess involves.

The results of operations for pulmonary abscess are full of promise. Fabricant reports 38 cases, with 29 recoveries and 9 deaths. Réclus reports, out of 23 operations which have been performed within the past ten years, 20 cures and 3 deaths. The old idea that adhesions between the lung and parietal pleura were a requisite for successful operation is passing into oblivion. Adhesions are unquestionably of great advantage. If adhesions are absent the operations can be carried out in two stages; at the first, suturing the two pleural layers; at the second, opening the abscess after a delay of a few days. Unfortunately, however, such delay is generally inadmissible—it means death. The abscess must be opened at once. In certain cases the parietal pleura may be sutured to the lung, but generally the patient's condition is such that the operation must be rapidly completed, the pleural cavity being protected as well as pos-

sible by sponges and gauze. Editorial (Medical News, Feb. 13, '97).

The measures recommended under FŒTID BRONCHITIS (*q. v.*) are all indicated here. Simultaneously and in addition to the measures employed to counteract the causative disease, remedies and food calculated to increase the strength of the patient greatly enhance the chances of recovery.

Pulmonary Gangrene.

Gangrene—*i.e.*, death and putrefaction of a more or less extensive area of the lung-tissue—occurs occasionally as a complication of pulmonary or infectious diseases.

Symptoms.—These vary according to the characters of the causative affection and the region involved, but, as a rule, intense fœtor of the expectoration and of the breath is the first indication that a necrotic process has begun. This peculiar fœtor may be said to be pathognomonic; it contaminates the patient's surroundings, and renders his presence almost unbearable where other patients are gathered, and isolation becomes necessary. It is far more offensive than in pulmonary abscess or bronchiectasis.

When the sputum is allowed to accumulate in a glass dish it separates into three layers: a superficial layer, which is frothy, yellowish gray; a middle layer, almost transparent and resembling pure serum; and a lower, a foul, greenish mass, streaked with blood in proportion as the vascular elements are involved in the destructive process. The mass contains various bacteria, pieces of small bronchi, fat-globules, pus-cells, and fungi, etc., and sometimes portions of lung-tissue.

The general manifestations are mainly those of the marasmus of pyæmia: great prostration, emaciation, weakness. Fever is, moreover, less marked and irregular

and attended with chills and profuse sweating. Exhausting coughing spells tend to increase the patient's discomfort. Two forms are recognized: the diffuse and circumscribed.

DIFFUSE PULMONARY GANGRENE is usually, though rarely, met with in lobar pneumonia as a result of pressure upon or occlusion of a large arterial trunk, especially the pulmonary artery. The lung, no longer supplied with blood, is transformed into a necrotic mass. The general symptoms are intense in proportion and death soon ensues.

CIRCUMSCRIBED PULMONARY GANGRENE.—As the name implies, this form of necrosis occurs in circumscribed portions of either lung. Occlusion of the arterial supply is also the causative factor here, but the difference is that a limited number of small vessels are occluded instead of a large trunk as in the diffuse form. An area, thus deprived of its blood, is, as a rule, clearly defined; several such may exist in the same lung. The gangrenous foci may gradually extend, but the normal effort of Nature is to create a limiting wall of connecting tissue. Sudden intense pleurisy or pyopneumothorax may suddenly appear from penetration of the abscess into the pleura. Bronchitis, catarrhal and croupous, may also be developed in this way.

The physical signs of circumscribed gangrene are generally quite obscure unless the necrotic process be near the surface, when, during the stage of consolidation, dullness may be elicited under percussion. Later on, when the tissues have broken down, the evidences of a cavity may present themselves—cracked-pot resonance—besides those of the causative affection. In large cavities cavernous and bronchial râles may also be discerned.

Diagnosis.—The diseases from which

gangrene must be differentiated are abscess and putrid bronchitis.

PULMONARY ABSCESS.—In this disease the foetor of the breath is not excessive; that of gangrene is such as to at once be recognized by its intense foulness and persistence. The division of the sputum into three parts presenting the characteristics noted is peculiar to gangrene.

PUTRID BRONCHITIS.—In this disease the odor resembles somewhat that of acacia-blossoms. The sputum does not contain disintegrated lung-tissue and is less dense. A history of bronchitis can usually be obtained, and the marasmus attending gangrene is not present. In early cases, however, the distinction can only be based upon the odor of the breath and expectoration.

Etiology.—Almost any pulmonary disorder may be followed by gangrene when the nutrition of parenchyma or its continuity have become impaired. In the latter case the bacteria of putrefaction, the staphylococcus albus or aureus, are the active etiological factors. It may occur as a complication of phthisis, pneumonia, influenza, bronchiectasis, wounds, contusions, variola, measles, typhus, etc. In children it sometimes presents itself as a sequel of cancrum oris.

Case of gangrene of the lung that followed an attack of uræmia. The breath was offensive, sputum dark, and there were frequent hæmorrhages of varying amounts. There were moderate fever and emaciation. The physical signs consisted of restricted respiratory movements and increased percussion-dullness over the apex of the left lung, including râles and bronchial breathing. The symptoms improved, only to recur for several months. Permanent recovery finally ensued. A. McPhedran (Amer. Med.-Surg. Bull., Aug. 29, '96).

Compression by tumors or aneurisms may occlude the arteries and arrest nu-

trition of the lung, while emboli due to the introduction of putrid substances may cause it by arresting the flow of blood through the smaller vessels. Circumscribed gangrene of this kind is often accompanied by cerebral abscess, through migration to the brain of a detached fragment of embolus, which in turn arrests the circulation in the cerebral region involved. Detached thrombi may also start a gangrenoid process in other parts of the lung. Gangrene may also be started by the penetration of foreign bodies, food, etc., into the bronchi, the bacteria of putrefaction entering simultaneously. It is more likely to occur in persons weakened by various diseases, or any habit tending to weaken the organism. Diabetes mellitus and alcoholism may thus predispose to gangrene.

Pathology.—The circumscribed areas are blackish or greenish, presenting ragged edges. The lung around the foci is inflamed, and the air-spaces contain epithelium, fibrin, and pus. Once formed, they may increase in size, the adjoining veins becoming filled with infectious thrombi. Portions of the latter may be carried into the circulation and set up inflammatory foci in various parts of the body. The vessels may also be eroded and thus be the source of copious hæmorrhage. If the patient recovers, the gangrenous portion of the lungs is entirely removed and a cavity is formed, the walls of which are changed into connective tissue. It may remain in this condition for a long time or become contracted. (Delafield.)

Pulmonary gangrene due to perforation of the œsophagus is rarely seen, and is almost always fatal. Case observed by writer terminated favorably. Schroeder (Centralb. f. inn. Med., Jan. 15, '98).

Case of a woman under treatment for diarrhœa and emaciation. Bothriocephala

lus-eggs were found in the stools and three worms were expelled by treatment. The symptoms persisted. Signs of infiltration of the lower lobe of the right lung appeared, bacilli staining by the usual methods for tubercle bacilli were found in the sputum, and the diagnosis was changed to tuberculosis of the lungs and intestine. Three days after the discovery of the pulmonary dullness the patient died. Autopsy showed bronchiectasis, small gangrenous abscesses of the lung, and ulcerative enterocolitis. Examinations showed the complete absence of tuberculous lesions and proved that the bacilli belonged to the group of smegma bacilli. Pappenheim (Berl. klin. Woch., No. 37, '98).

Prognosis.—The prognosis of diffuse gangrene is obviously of the gravest kind. In circumscribed gangrene, however, the case is difficult if the affected areas are not restricted, the greatest danger being exhaustion and fatal hæmorrhages. The latter may cause death when recovery seems assured. The prognosis is rendered far more favorable, however, if surgical measures are resorted to.

Treatment.—The most important features in the treatment of gangrene are to enhance the strength of the patient by nutritious diet, to administer remedies that tend to encourage the separative process and disinfect the necrotic foci. The first requisite is best satisfied by liquid concentrated food, administered in fixed quantities at regular intervals, the patient being encouraged to eat by catering to his tastes. Before partaking of food, however, he should carefully wash his mouth with some antiseptic solution devoid of taste. A solution of borax best answers the purpose, it serves as a good mouth-wash and as an efficient gargle. Alcoholic beverages should be avoided, they tend to increase the chances of hæmorrhage by stimulating the heart. The separa-

tive process may be encouraged by the administration of creasote in gradually-increased doses and aided by the inunctions of iodoform, or, better still, eucophen-oil, as recommended by Flick in the treatment of tuberculosis. (See TUBERCULOSIS, PULMONARY, TREATMENT.)

Antiseptic solutions may also be administered in the form of spray. The most active disinfectant is a solution of permanganate of potassium 1 grain to the ounce, the patient taking deep breaths to inhale the spray. A saturated solution of chlorate of potassium is more agreeable, but less effective. Yeo's respirator (a wire-gauze funnel-like instrument) may be used constantly by the patient to inhale terebene or turpentine, which tend greatly to modify the horrible fœtor with which the patient is surrounded, while favorably influencing the diseased areas if these are reached.

In all cases of gangrene of the lung which are progressive and not absolutely diffuse, operation should be performed. In the absence of pleuritic adhesions the pleural cavity is shut off by gauze packing or by suturing. When the cavity has been thoroughly opened and drained, it should be cleansed daily by irrigation and afterward tightly packed with iodoform gauze. A. H. Levings (N. Y. Med. Jour., Oct. 14, '99).

SURGICAL MEASURES.—Among the surgical measures, pneumotomy, or simple incision into the lung, is the preferable operation. It is indicated, according to Réclus, when the cavity, though distinctly circumscribed, is large, and when there are evidences of toxæmia through retained putrid contents.

Case of a man treated surgically for gangrene of the lung. An incision being made in the left second intercostal space, the lung-tissue covered by pleura was seized with a pair of forceps. The pleura and the lung were then successively in-

cised, about two centimetres of lung having to be traversed before the purulent cavity, which had a capacity of 2 fluidounces, was reached. The cavity was carefully disinfected, its parietes washed with camphorated naphthol, and finally two large drainage-tubes secured in it by suturing on each side. All coughs, expectoration, and morbid physical signs disappeared. Périer (*Lancet*, Apr. 2, '92).

Pneumonotomy performed in a case of gangrene of the lung in which the expectoration had been abundant and foetid for two years. The wound healed in three weeks. Podreze (*Revue Gén. de Clin. et de Thér.*, Nov. 16, '95).

Of the three varieties of pulmonary gangrene,—the diffuse, the circumscribed, and the pleuro-pulmonary,—the last two are best treated by operation. Portions of one or more ribs are removed, the gangrenous cavity is entered, and all pus-pockets broken up. Free drainage is established. If the pleura is not adherent, the risk of the operation is increased, but the most serious complication is hæmorrhage, which can be stopped only by firm packing. H. Vulliet (*Revue Méd.*, Feb. 20, 1900).

The fears formerly entertained that collapse of the lung would follow penetration from the surface have been allayed by modern experimentation, and small portions of the lung have been removed without untoward results, recovery following in the majority of cases.

Pneumonotomy consists in making a free incision down to the pleura, resecting one or more ribs if needed. The cautery-knife is then used to penetrate the pulmonary cavity. When the lung is adherent to the chest-wall, this step of the operation is easy. When, however, it is not, the majority of surgeons prefer to elevate the portion of lung overlaying the cavity and to fasten it to the external wound by a row of sutures. Adhesion taking place in a few hours, the cautery may then be used to open the gangrenous focus. Success, how-

ever, has also followed incision through pulmonary tissue.

In gangrene the mortality without operation is about 80 per cent. In certain cases of diffuse gangrene operation is out of the question, and the case is hopeless. In circumscribed gangrene operation offers to the patient a fair chance of recovery.

The operation, if otherwise indicated, should be performed, adhesions or no adhesions.

Heydweiller collected 40 cases treated by operation prior to 1892, with 22 recoveries, 4 improvements, and 14 deaths. The more recent cases of Réclus number 14 operations, 11 of the patients being cured, 1 being improved, and only 2 having died. Editorial (*Med. News*, Feb. 13, '97).

The cavity is carefully emptied of its contents, gently relieved of all *detritus*, disinfected, and drained.

In establishing free drainage in cases of gangrene, it is of the first importance to have a soft tube of suitable and measured length, so as to avoid irritation, coughing, and erosion of the larger blood-vessels. The putrid expectoration and fever should diminish or cease soon after the operation. In 55 cases of gangrene following pneumonia recovery took place in 39; in 4 cases following bronchiectasis only 1 recovered; in 7 embolic cases only 2 recovered. Tuffier (*La Sem. Méd.*, Aug. 21, '97).

Adhesions between the two pleural surfaces should be secured before incising the pleura, to prevent collapse of the lung by deep sutures before the pleural incision is made. Irrigation is dangerous after the operation; it causes coughing and may thus contaminate the healthy lung-tissue. Tamponade has the advantage over drainage that it is hæmostatic, while it induces drainage. The patient must not be allowed to lie too long on the healthy side to prevent infecting the healthy lung with the gangrenous secretions. Fritz Berndt (*Wiener klin. Rundschau*, May 27, 1900).

Pneumonectomy, or exsection of a portion of the pulmonary tissue, formerly failed, according to Delagénière,

because surgeons were content merely to drain the gangrenous focus, instead of extirpating it as completely as possible. The pleura should be opened very freely at the side by an L-shaped or U-shaped incision, or behind by a vertical one, according to circumstances. The operator should not hesitate to resect sound ribs, if necessary. The operation is concluded in the same manner as the latter, by drainage. Strict antisepsis is an all-important element of success.

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PULMONARY CIRCULATION, DISORDERS OF.

Pulmonary Atelectasis.

Definition.—Atelectasis is a congenital or acquired inability to adequately expand all the pulmonary air-cells, and resulting in imperfect oxygenation of the blood.

Symptoms.—The symptoms depend upon the degree of involvement of the respiratory tract. If but a few lobules are collapsed, compensatory action of other parts of the lung annuls the deficiency. If, however, the portions involved compromise about one-eighth of the respiratory capacity, there is dyspnoea and imperfect oxygenation.

In the CONGENITAL form the infant is born with its skin and mucous membrane cyanosed, thus constituting what is popularly termed a "blue baby." It may be born dead or dying from asphyxia. If the atelectasis is only partial, the infant will present symptoms varying in intensity with the area involved: shallow, rapid breathing; cold extremities, drowsiness, spasmodic movements, and convulsions. Instead of crying lustily, it gives forth a plaintive whine, the chest does not expand, the intercostal spaces are depressed, and examination reveals

absence of fremitus in the undilated pulmonary region. If the child continue in this condition, local complications of an inflammatory kind are likely to occur.

Diagnosis.—Atelectasis is to be mainly differentiated from pulmonary embolism, pneumonia, and pleurisy.

PULMONARY EMBOLISM.—In this disorder there is pain, bloody expectoration, and evidences of a febrile process that does not exist in atelectasis.

PNEUMONIA.—In the croupous form there is marked crepitus and high fever following chill. There is also pain.

PLEURISY.—In this affection fever is also present; friction-sounds may be heard; percussion shows circumscribed area of dullness, shifting when the patient's position is changed.

Etiology.—Congenital atelectasis is mainly the result of pulmonary expansion due to incompetence of the respiratory centre of the infant. But this, in turn, may be the result of improper oxygenation of the blood and reabsorption of carbonic acid through pressure upon the umbilical cord. This may result from twisted cord or through constriction, especially during protracted labor. When the respiratory centre is called upon at birth to initiate pulmonary respiration, the impetus fails or is not given. Premature birth may also be accompanied by atelectasis through insufficient development of the respiratory centre.

Atelectasis may be caused by malformations and intra-uterine diseases of the organs of respiration or circulation, or it may be due to hæmorrhage with pressure upon the respiratory centre, or to the premature and feeble condition of the infant. Acquired atelectasis may be due to penetration into the bronchial tubes of viscid mucus or of some of the products of intra-uterine life. A. Jacobi (*Arch. of Ped.*, Jan., Dec., '88).

ACQUIRED atelectasis usually occurs as the result of a condition involving reduc-

tion of the lumen of the respiratory tract. Foreign bodies may thus cause atelectasis by preventing the ingress of air, while the residual air is gradually eliminated by contractions of the thoracic walls and diaphragm, or absorbed. False membrane, meconium, muco-purulent masses, blood, etc., have thus brought on this distressing condition. Processes that interfere with expansion of the chest by pressing on the lung—spinal curvature and other diseases of the bony frame-work, tumors, effusions into the pleural or pericardial cavities, aneurism, etc.—may also bring on atelectasis.

Case of pulmonary atelectasis of great extent, the normal resonance being replaced by flatness over the whole of the left lung and the respiratory murmur being weak, while the heart was dislocated to the left by the distended right lung. At the autopsy the left bronchus was found contracted and the lung collapsed and sclerotic. There was slight pigmentation of the left lung; this suggested that the organ once functionated and that early in life the bronchus was constricted and the lung collapsed. It was thought to be probably of specific origin. Rohmer and Borchert (*Deut. Arch. f. klin. Med.*, Dec. 22, '97).

Pathology.—The atelectatic areas—though hepatized, “carnified,” or firm—do not show histological change, barring, perhaps, slight dilatation of the vascular supply. The collapsed cavities, whatever be their size, can always be inflated with a blow-pipe, as shown by Legendre and Bailly. The affected parts sink in water and are resistant under section. When causative disorders are present, the post-mortem evidences vary accordingly.

Collapse of the lobules sometimes occurs as a complication of capillary bronchitis. Pertussis and wide-spread broncho-pneumonia may also occur as causes.

Prognosis.—The prognosis varies according to the extent of the area involved. When small areas are atelectatic, recov-

ery is usual, but extensive reduction of the respiratory capacity is seldom recovered from. In premature births the chances are greatly against the infant. The same is the case when atelectasis is the result of some pulmonary disorder.

COMPLICATIONS.—Pulmonary tuberculosis, pleurisy, and broncho-pneumonia are frequently observed in these cases and greatly compromise the issue. When atelectasis is due to pressure,—*i.e.*, occurs as the result of effusions into the pleura, aneurism, tumors, etc.,—the prognosis is very unfavorable. Emphysema sometimes presents itself in atelectatic infants, but as a compensating factor, its presence increasing the respiratory area.

Treatment.—The important indication in this disorder is to increase as much as possible the vital activity of the patient. Gentle massage under warm bedclothes, the friction being always in the direction of the heart, tends greatly to increase the activity of the circulation. Laborde's method of rhythmical traction of the tongue is said to be valuable. Oxygen inhalations would seem to be indicated, though care should be taken to avoid overstimulation, lest pulmonary hyperæmia follow. Pure air is essential in such cases. A little brandy, a few drops in sugar and water, given from time to time, is generally recommended. Tonics—strychnine, especially—are of value. Nutritious, though easily-digested, food, when the child is old enough, is of great importance as a curative factor to antagonize the vital adynamia that lies back of the trouble.

Inversion of the child preferred to establish respiration, the child lying upon the back, head downward, upon the forearm of the operator, whose fingers are hooked into its shoulders. The arms of the child fall downward as the hands of the operator are depressed, and the chest is thus dilated. The press-

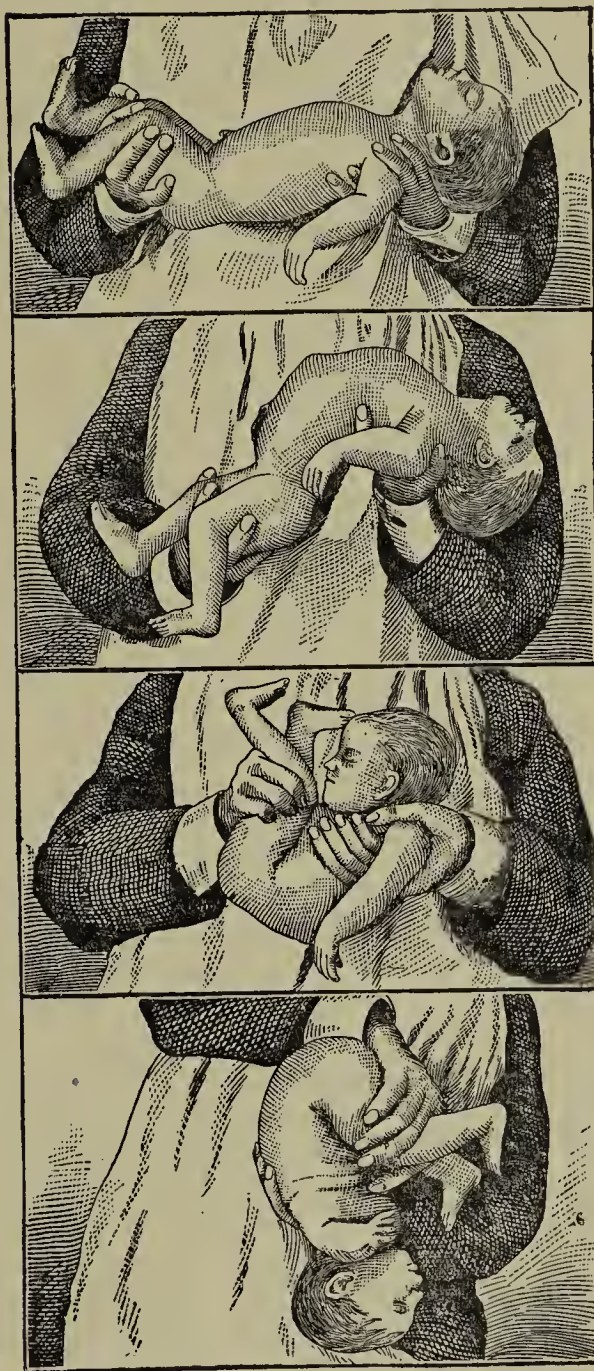
ure being then suddenly removed a respiration takes place. Such a movement also favors the removal of mucus from the air-passages. Reynolds (*Archiv f. Kinderh.*, B. 11, H. 1, '88).

In asphyxia of the newborn mouth-to-mouth inflation favored, the infant's nostrils being closed and a moderate degree of pressure used at first to prevent forcing the epiglottis over the larynx. This is a better method than inflation with a catheter, since most of the air introduced by this instrument returns at its side. O'Dwyer (*N. Y. Med. Jour.*, Mar. 9, '88).

Harvey L. Byrd's method of artificial respiration advocated. The physician places his hands under the middle portion of the child's back, with their ulnar borders in contact and at right angles to the spine. With the thumbs extended, the two extremities of the trunk are carried forward by gentle, but firm, pressure, so that they form an angle of 45 degrees with each other in the diaphragmatic region. Then the angle is reversed by carrying backward the shoulders and the nates. E. L. Crutchfield (*Med. Bull.*, Sept., '92).

Following method of resuscitation advocated. The infant is grasped with the left hand, the neck resting between the thumb and forefinger (Fig. 1), the head falling far backward. The upper portion of the back and scapulæ will rest in the palm of the hand, the other three fingers being inserted in the left axilla, raising it upward and outward. Next, the knees are grasped (Fig. 2) so that the right one will rest between the thumb and forefinger, the left between the forefinger and middle finger. The back of the thighs will rest in the palm of the operator's hand. Next, the pelvis and lower extremities are depressed (Fig. 3), while the left hand gently bends the dorsal region of the spine backward. To excite expiration the movement should be reversed, the head, shoulders, and chest being brought forward and the ribs closed upon each other. At the same moment the thighs are brought forward and rested upon the abdomen. Dew (*Med. Record*, Mar. 11, '93).

Failure to relieve asphyxia is due to obstruction of the glottis by the backward pressure of the tongue; the tongue should be well drawn forward. Air can then be readily forced into the infant's lungs either by direct application of the



Method of resuscitation. (Dew.)

accoucheur's lips to the lips of the child or by passing a soft catheter into the child's trachea. This will usually be sufficient for blue or cyanotic infants; for the pale and collapsed ones, pressure over the cardiac region, rapidly and rhythmically, to imitate the normal

heart-beat, must also be used. Oehlschläger (*Amer. Jour. Med. Sci.*, Apr., '94).

Following procedure is an improvement over the Schultze method. The child is laid upon a table, its neck supported by a roll. The feet are so seized that the thumbs are in contact with the child's soles, the index finger with the back of the feet, the ring-finger resting upon the tendo Achillis. The remaining fingers are closed. The knees, hips, and spine are then bent in regular motions, the knees touching the breast. Compression of the abdomen, with expiration, results; then, by stretching out the body, inspiration follows. The larynx is not compressed, as may be the case by the Schultze method. As an alternative measure, the suspension of the child by the legs is suggested. At the same time the finger may be passed down the throat to facilitate the removal of fluids, provoke vomiting, and thus compress the lungs. Such a method tends to prevent aspiration pneumonia. Rosenthal (*Univ. Med. Mag.*, Apr., '95).

Procedure based on that introduced by Schultze, but less dangerous. The infant is held vertically with the head down; the mouth and pharynx are freed from mucus. The cord is then tied, and the infant is placed in a sitting posture on a table, with the legs extended and separated; the physician takes up a position behind the infant, passes one hand into each axilla, the thumbs resting on the scapulæ, and the other fingers applied to the front of the thorax; the trunk is then bent forward toward the angle between the separated legs, while, at the same time, the thorax is compressed by the operator's hands. The lungs are thus emptied. The body is now brought back into a horizontal position; the thorax expands, causing marked inspiration. Those movements of flexion and extension are repeated with the same frequency as the normal rhythm of respiration in the newborn. This method used for the past two years, and has never failed. Even in cases of pronounced asphyxia about a dozen of those movements have sufficed to revive

the infant. Minkévitch (*Semaine Médicale*, No. 45, 1902).

Pulmonary Congestion.

Congestion of the lungs typifies that observed elsewhere in the organism, and may, therefore, be divided into two classes: active and passive.

Active Pulmonary Congestion.—

SYMPTOMS.—The symptoms vary with the intensity of the congestion and the amount of lung-tissue involved. Dyspnoea, cough, frothy expectoration, localized pain, wheezing, and accelerated breathing are usually observed; occasionally the expectoration is tinged with blood. In rare cases there is active pulmonary hæmorrhage, followed by death (Devergie). All these symptoms, according to Ball, may be found in pulmonary congestion of malarial and gouty origin. Death may also occur as the result of asphyxia, brought on by the mechanical blocking of the tubes by excess of secretion (Musgrave). The temperature rarely surpasses 100° F., and the pulse is tense and bounding. In favorable cases defervescence usually begins twenty-four to thirty-six hours after the onset of the active symptoms.

Both lungs are usually involved, and in mild cases the hyperæmia gives rise to appreciable signs only at the base. Fine fremitus may be detected; the breath-sounds are unusually audible, the expiration being prolonged and harsh. Moist subcrepitant râles attend the more severe cases, but these are also most evident toward the bases.

ETIOLOGY AND PATHOLOGY.—Active congestion may occur as a primary disorder, especially in persons in whom the kidneys are diseased. Exposure to damp and cold air while the surface is warm, as is the case during bicycle-riding, or prolonged bathing in cold water, may under these conditions bring on pulmo-

nary hyperæmia, which in rare cases assumes a grave form. In the vast majority of cases, however, pulmonary active congestion is due—not to speak of the conditions such as pneumonia, pleurisy, bronchitis, etc., of which it forms an early stage—to the inhalation of steam, hot air, and other irritating factors. It has also followed violent emotions or fright. In the latter case paresis of the vasomotors is probably the most important pathological feature. Congestion of the mucous membrane and the presence of bloody and frothy mucus constitute about all the morbid conditions found post-mortem.

TREATMENT.—In cases due to exposure, dry cups, mustard foot-baths and opium internally, followed by a saline purgative, usually suffice to overcome the hyperæmia. In cases brought on by irritants—steam, hot air, acid fumes, etc.—the bromides in large doses are very effective. When the dyspnœa is severe, however, venesection is indicated, especially if the patient be large and plethoric: a class of individuals in which active congestion is apt to occur. Wet cups should be used if venesection cannot be resorted to. Tincture of veratrum viride or of aconite in small, but frequently-repeated, doses, and closely watched, will then prove effective in maintaining the pulmonary circulation at its normal level.

Passive Pulmonary Congestion.—The passive form is generally due to cardiac diseases, especially those in which the mitral and tricuspid valves are involved, and when dilatation and fatty degeneration are present. It may also occur as a complication of cerebral lesions and as a result of asphyxia. Tumors may also give rise to passive congestion by pressing upon a large venous trunk.

SYMPTOMS.—The symptoms of this

condition do not vary greatly from those of active congestion, but they do not appear suddenly, the progress of the pulmonary disorder depending upon that of the causative affection. In heart disease, for instance, the dyspnœa only appears when compensation begins to fail. In pulmonary tumor active symptoms only occur when the pressure of the neoplasm is sufficient to cause a degree of vascular stenosis for which collateral circulation cannot compensate. Cough and the expectoration of frothy and blood-stained serum, which upon examination is found to contain pigmented alveolar epithelial cells, constitute the characteristic signs of this form of hyperæmia.

ETIOLOGY AND PATHOLOGY.—The congestion being due to mechanical impediment to the flow of blood through the vessels, the latter are distended and the whole lung is enlarged. The vascular engorgement causes the pulmonary tissue to become erect, firm, and resisting. When cut, it appears reddish brown; hence the name “brown induration” often given to this condition. There is marked increase of the connective-tissue elements and distension of the smaller vessels and alveolar capillaries. The alveolar walls are filled with cells containing altered blood-pigment, while their cavity contains epithelial cells in various stages of metamorphosis.

TREATMENT.—The treatment is obviously that of the causative disorder, but the condition may be greatly relieved by venesection. In desperate cases aspiration of the right auricle may be tried.

Hypostatic Congestion.—This is a form of passive congestion in which the blood accumulates in the posterior and inferior portion of one or both lungs, as a result of great prostration and debility.

SYMPTOMS.—As noted by Piorry,

hypostatic congestion may be suspected when old and debilitated patients, contrary to their custom, sleep with opened mouth. This suspicion becomes confirmed when slight cyanosis indicates that proper oxygenation of the blood is not taking place. Œdema of the lower extremities is observed late in the history of the disease. In a large proportion of the cases, however, these characteristic symptoms are not detectable, and the diagnosis has to be based upon the physical symptoms. Slight dullness at the base of the lungs, feebleness of the respiratory murmur, and moist râles are the most marked of these, and suggest the presence of hypostatic congestion when other active symptoms attending inflammatory disorders of the lung are not present.

ETIOLOGY AND PATHOLOGY.—This form of congestion is generally observed in elderly people who are obliged, through disease, to remain a long while in the dorsal position. The shoulders being raised by the pillows, the blood normally accumulates in the bases. Chronic diseases, long-continued fevers, and cardiac disease attended by weakness of the heart-muscle may thus favor the development of the disease. Fractured limbs in the aged may also prove indirectly causative if the patient is allowed to remain in bed beyond a certain time. The lesions resemble those of a mild lobular pneumonia. The capillaries are enlarged, the air-cells more or less collapsed, and the lung-tissue is dark red, dense, and engorged with blood and serum: a condition which has been termed "splenization."

TREATMENT.—The prevention of hypostatic congestion should be an important feature of the measures adopted in cases of paralysis, protracted tuberculosis, cancer, fracture, typhoid fever,

etc., especially when these occur in old subjects. The posture should be frequently changed, not only from side to side, but also in respect to the elevation of the shoulders. The semiprone position—the patient lying with one side of his abdomen touching the bed—is a useful one to prevent or relieve the local engorgement, but he should be allowed to leave his bed as soon as at all practicable. It is important to sustain cardiac action; this may best be done by means of strychnine, nitroglycerin, caffeine, or digitalis.

Pulmonary Hæmorrhage.

Pulmonary hæmorrhage or bleeding within the lungs may be caused by various disorders and injuries, and erosion or rupture of the walls of the pulmonary vessels, large or small. It may be most conveniently divided into two forms: the *broncho-pulmonary* (bronchorrhagia), in which the blood flows into the bronchi and is eliminated through the mouth—constituting hæmoptysis; and *pulmonary apoplexy* (pneumorrhagia), in which the blood accumulates in the pulmonary parenchyma, or the lung-tissue and the air-cells.

Broncho-pulmonary Hæmorrhage.—Although this form of hæmorrhage is one of the prominent symptoms of pulmonary tuberculosis, it is important to realize that the latter affection is by no means the only one in which hæmoptysis may occur. It is a comparatively frequent accompaniment of cardiac disorders, diseases of the nasal cavities, pharynx, larynx, and trachea; aneurism; menstruation; arthritism; purpura hæmorrhagica; hæmophilia; the *Distomum pulmonale*, and other disorders.

Symptoms and Diagnosis.—In rare cases the quantity of blood is so great that the flow occurs from the nose and the mouth simultaneously. Again, it

may be swallowed as rapidly as it reaches the laryngeal aperture, enter the stomach, and be regurgitated. But, in the majority of cases, the flow is not great; the patient first experiences a warm, salty taste, then ejects more or less great quantities of bright-red frothy blood. It may be brought up with a cough, or suddenly fill the mouth and be expectorated. Small quantities may be brought up from time to time and merely permeate the saliva with films or streaks. The first hæmoptysis may prove to be the last; it may recur a few hours later or the next day. When repeated hæmorrhages occur, the last sputa assume a dark aspect; this represents blood which has sojourned in the bronchi, and usually indicates an early cessation. Dyspnoea and a sensation of heat in the chest are sometimes complained of. If the hæmorrhage is great, unconsciousness may occur.

Besides pulmonary tuberculosis (see TUBERCULOSIS), of which pulmonary hæmorrhage is one of the prominent earlier symptoms, and the diseases such as purpura hæmorrhagica, hæmophilia, scurvy, malignant infectious diseases, hepatic cirrhosis, etc., that are often attended by this symptom, hæmoptysis may occur in the following disorders:—

Cardiac Disorders.—Hæmoptysis frequently occurs when valvular disorders involving stenosis are present, and especially when the mitral and aortic valves are diseased. Besides the general symptoms of the cardiac affection, the character of the blood assists in establishing the diagnosis. Instead of being bright red and frothy, as in tuberculosis, it is, as a rule, dark and more or less mixed with mucus. It does not present itself in the mouth in sudden jets, but usually comes up as would muco-purulent sputa. Again, the sanguineous expectoration

continues several weeks, sometimes without causing untoward symptoms.

Menstruation.—Hæmoptysis sometimes replaces menstruation in women. The hæmorrhages are then periodical; or they may be observed as a sequel to the menopause and occur repeatedly, also at regular intervals. All such cases should be watched, debility and vulnerability of the pulmonary structures being at times either concomitant or resulting conditions under such circumstances. Periodical hæmoptysis is occasionally observed after removal of the ovaries.

Naso-pharyngeal Disorders.—These are frequently attended by slight hæmorrhage; as a rule, the blood is brownish and the symptoms of chronic naso-pharyngitis or other local disorders may be present. Tumors, especially fibroma and sarcoma of the nose and naso-pharynx, may give rise to copious hæmoptysis; but recurrent epistaxis often attracts attention to the seat of the disease. In a case of my own, copious recurrent hæmorrhage was traced to an ulcer in the pharyngeal vault, which proved to be tuberculous. Varices of the pharynx and lingual tonsil occasionally rupture, and may give rise to a copious flow of blood.

Laryngeal Disorders.—In cancer and sarcoma of the larynx, angular foreign bodies in the laryngeal cavity, rupture of a superficial vessel, especially after straining or vomiting and laryngitis sicca, hæmoptysis is of occasional occurrence. Here, also, the blood usually comes up as would ordinary mucus, but it is often unmixed and distinctly arterial. When due to the presence of tumors, shreds of *detritus* are often coughed up simultaneously.

Aneurism.—This is not an uncommon cause of hæmoptysis, through the pressure exerted by the aneurismal mass upon

the pulmonary structures and erosions of their tissues. The trachea is frequently pressed upon in this manner by aortic and innominate aneurisms, and the bleeding spot may occasionally be located with the aid of the laryngoscope. Aneurisms of the pulmonary artery, when they rupture, suddenly fill the lung with blood, causing death. Aortic aneurisms may also rupture into the bronchial tract. The blood is ejected in mouthfuls and the secondary manifestations—pallor, unconsciousness, etc.—rapidly follow.

Vascular Fibrosis.—In atheromatous degeneration, especially in elderly persons, the pulmonary capillaries and small vessels of the bronchi sometimes yield, giving rise to a more or less copious flow. This form of hæmoptysis has been called by Sir Andrew Clark “arthritic hæmoptysis,” since it is usually met with in arthritic subjects. It has occasionally proved fatal; but, as a rule, it constitutes a benign form of hæmoptysis.

Emphysema.—This affection is sometimes attended by hæmorrhage. The blood, unless the quantity be great, is not brought up as it leaves the ruptured capillaries; it usually sojourns some time in dilated alveoli, and is coughed up in thick masses, which sometimes assume the shape of the smaller tubes and are voided as casts.

Thoracic Injuries.—Blows upon the chest, besides penetrating and crushing wounds, often cause hæmoptysis, which may continue several days. (See THORAX, INJURIES OF.)

Unassignable Causes.—Finally, recurrent hæmoptysis sometimes occurs without apparent cause, notwithstanding careful search, and the subject, after a period of great anxiety, does not find his health to have become impaired, and lives many years—sometimes as a stand-

ing negation of an injudicious and hasty diagnosis. Now that microscopical examination of the sputum alone forms the basis of the decision when tuberculosis is suspected, such errors are not as frequent. Cases of this kind, however, should be watched, and, if the patient be weakly and anæmic, measures tending to improve the general tone should be instituted and continued long enough to restore the patient to perfect health.

PULMONARY APOPLEXY.—This consists in extravasation of blood into the air-cells and interstitial pulmonary tissue, as a result of aneurismal rupture, penetrating wounds, ulceration involving a large vessel, septico-pyæmia, cerebral disease, and other conditions in which the pulmonary parenchyma is torn.

As here understood, pulmonary apoplexy only applies to rarely-observed cases in which the organ is overwhelmed with blood, which gushes out of the mouth in great volume. Intense dyspnoea, collapse, and death follow in quick succession. In some cases the hæmorrhage is, so to say, localized, and the hæmoptysis is not severe. Soon, however, an abscess and at times gangrene appear, and the patient succumbs from septico-pyæmia.

Treatment of Pulmonary Hæmorrhage.—The treatment of pulmonary hæmorrhage not only varies with the cause, but therapeutic measures addressed to the cardio-vascular system at large are also necessary. Examination of the upper respiratory tract, the nasopharynx, the pharynx, the larynx, the trachea, the base of the tongue, etc., may reveal a bleeding spot and call for the local application of styptics; besides this, however, measures tending to reduce the vigor of cardiac action—rest, etc.—must be resorted to. A third class of therapeutic indications are those cal-

culated to prevent the recurrence of the hæmorrhages.

If the hæmorrhage is a copious one, the patient should at once be placed in a reclining position, his head being turned to one side to enable him to clear his mouth as fast as it is filled. Whatever be the cause of the bleeding, it cannot be clearly established while it lasts; general measures are therefore alone indicated for the time being. Several remedies at present commonly employed are more pernicious than helpful, particularly ergot, digitalis, and the ice-poultice. Ergot increases vascular tension; digitalis produces the same effect, particularly upon the pulmonary artery; the ice-poultice contracts the peripheral vessels and causes engorgement of the deeper vessels.

Probably the most effective agents are morphine and atropine, $\frac{1}{4}$ grain of the former and $\frac{1}{100}$ grain of the latter, given together hypodermically. At the same time, a large handkerchief, napkin, towel, or bandage should be *tightly* wound around each extremity, as near the trunk as possible, to momentarily arrest the return of the venous blood to the thoracic organs. This procedure, if properly carried out, at once reduces the pulmonary engorgement and usually arrests the flow unless it is overwhelming. Nitrite of amyl is another remedy which acts promptly. When these agents cannot be obtained, a tablespoonful of salt dissolved in a tumblerful of water generally arrests the flow when the bandages are also applied as stated.

After the hæmorrhage has ceased, the patient should remain where he is an hour or so, then be carried on a litter to a cool room. He should not be allowed to speak. Fainting tends to assist the formation of a clot, and the patient, as a rule, recovers his senses within a short

time. The bandages should be removed gradually, fifteen minutes being allowed to elapse between each operation, so as to avoid a sudden tension of the pulmonary arteries. Aconite or veratrum viride may then be used with advantage.

The diet should be light, and easily digested food should be selected. Alcoholic and other stimulants should be strictly forbidden. Large quantities of liquid of any kind and hot beverages tend to bring on a recurrence of the flow. To assist in preventing this, the formation of a clot should be encouraged; this is best accomplished by chloride of calcium: 10 to 15 grains every two hours, in glycerin. Saline purgatives are valuable to reduce vascular tension, but they should not be utilized when the patient has been greatly weakened by the hæmorrhages if other measures are effective.

The hæmoptysis observed in elderly persons, and due to vascular disorders, is, according to Sir Andrew Clark, aggravated or maintained by the frequent administration of large doses of strong astringents, by the application of ice-bags to the chest, and by indulgence in liquids to allay the thirst created by the astringent. The treatment found most successful by him in these cases is diet, quiet, restricted use of liquids, stilling of the cough, calomel, salines, alkalies with iodide of potassium, and frequently renewed counter-irritation. (See also TUBERCULOSIS.)

Pulmonary Embolism.

This consists of a mechanical obstruction of one or more pulmonary arteries by an embolus or thrombus.

Symptoms.—While a diminutive infarction may pass unnoticed, complete occlusion of a large pulmonary artery may occasion instant death. Symptoms arise when the embolus does not completely fill the lumen of the artery in-

volved, or when the latter is not of sufficient size to completely disturb the pulmonary circulation, even though the vessel be completely occluded. Under these circumstances, dyspnœa is experienced. It gradually increases in severity, and may be preceded by unconsciousness and convulsions. The patient gasps for breath and indicates, by his frantic efforts to inhale, the intensity of his suffering. The pulse becomes weak and thready; the skin is cold and clammy and is covered with sweat. Severe localized pleuritic pain and a hard and harassing cough are usually present, and the patient expectorates masses of bloody gelatinous mucus. This reveals, upon microscopical examination, peculiar large lymph-cells resembling alveolar cells and embodying blood-corpuscles. These giant cells are thought to transform the blood-corpuscles into pigment-matter. They are seen especially in cases of heart disease, and are known as the "cells of heart-failure" (Whittaker). As the case progresses, local suppuration with metastatic abscesses occur, and all the evidences of pyæmia may appear. Dissolution of the thrombus may take place and the abscesses may undergo resolution; but, as a rule, the prognosis is serious.

Diagnosis.—When associated with the symptoms enumerated,—dyspnœa, syncope, bloody expectoration, etc.,—the physical signs assist in establishing the diagnosis. But they are only clearly obtained when the lesion is not too deeply seated. A localized consolidation giving rise to dullness under percussion, bronchial respiration, increased resonance, and a friction-sound, when the tension is near the pleura, represent the only signs which may be attributed to the embolus, all others being due to conditions developed secondarily.

Four typical cases of pulmonary embolism in childbed with severe symptoms noted, three ending fatally. The fourth occurred in a woman who had passed through a normal labor and got up on the tenth day; one main branch seems to have been plugged, but the patient recovered. Vogt (*Norsk Mag. for Lægevid.*, p. 1, 130, '97).

Etiology and Pathology.—Pulmonary embolism is due to stasis, in the majority of cases, the primary factor being a pulmonary or cardiac affection. The infarct generally consists of a mass of leucocytes and red corpuscles. It is usually firm and brownish and varies in size from that of a cherry to that of an entire lobe, since in some cases the entire vascular supply of a lobe is involved. Its envelope is formed of a thin film of fibrin. Hæmorrhagic infarctions often develop near the pleura and at the back of the lower lobe.

Wyders reports 9 cases of fatal pulmonary embolism after gynæcological operations, several of them of minor character. Four of the patients were suffering from extensive carcinoma and another from septic endometritis. All the other cases were uninfected and uncomplicated. Mahler had 22 cases of pulmonary embolism—10 post-partum and 12 after gynæcological operations. Welch mentions four cases of thrombosis of the left leg occurring among 131 cases of appendicitis. Biggs reports the condition once subsequent to fracture of the neck of the femur, once to fracture of the acetabulum and spine of the ischium, and thrice to operation. E. L. Keyes (*New York Med. Jour.*, April 5, 1902).

Treatment.—This can only be symptomatic, the patient's strength being sustained and the patient's position so adjusted as to facilitate respiration; this is usually best accomplished by elevating the upper part of the body. Gessner (*Centralb. f. Gynäk.*, No. 6, '97) recommends hypodermic injections of ether or morphine.

Pulmonary Œdema.

Definition.—Œdema of the lungs is due to the escape of serum through the vascular walls into the alveolar wall and interstitial tissue.

Symptoms.—Œdema appears and progresses more or less insidiously, the dyspnoea resulting from reduced respiration being marked in proportion. The respiration at first becomes hurried; a feeling of suffocation is experienced, accompanied by considerable anxiety and great muscular effort to facilitate the respiratory act. Cyanosis soon appears if the effusion involves much interstitial tissue, and intense suffering is sometimes witnessed. The infiltration is usually bilateral and ascends from the lower lobes.

The sputum may not be increased at first, but, as soon as the quantity of serum in the alveoli becomes great, it becomes very abundant and frothy. In some cases it is thin and watery; in others it is sufficiently viscid to markedly increase the dyspnoea through laryngeal obstruction. A peculiarity of the sputum at this stage is that it is more or less tinged with red, due to the presence of red blood-corpuscles. It may also contain urea.

The pulse is generally rapid and feeble, the weakness increasing as the infiltration progresses. No fever is present unless due to an intercurrent or underlying affection. The extremities become cold and the patient in extreme cases dies from heart-failure and carbonic-acid poisoning.

Examination at once reveals the reduced respiratory area, through inspection, the motions of the chest being restricted; percussion shows dullness over the infiltrated regions and resonance—at times tympanitic—above; auscultation, eliciting moist mucous and submucous râles, with gurgling, increasing as the involved tissues are approached. With

Bianchi's phonendoscope the gradual progress of the œdema can generally be traced with accuracy.

Diagnosis.—The diagnosis is not difficult, owing to the comparative suddenness of the onset, the demarkation between the free and the infiltrated area, and the absence of fever.

BRONCHO-PNEUMONIA.—This affection presents some points of resemblance; but the fever is marked and the physical signs are different, no clear distinction being traceable between the affected and non-affected areas. The mucous râles occur late in the course of the disease; in the œdema they are present almost from the start.

HYDROTHORAX.—This affection also presents considerable resemblance to œdema, but change of position does not alter the area of dullness in œdema, whereas the flow of liquid to another part of the chest causes a corresponding change in the seat of the dullness in hydrothorax. Moist râles are not present in the latter unless due to a concomitant disorder.

Etiology and Pathology.—Œdema of the lungs usually occurs as a final complication of other affections, but it may appear idiopathically after a too-hot bath, the copious ingestion of ice water, etc. It is thought to be due to one of three general causes: paresis of the vascular walls, impediment to the free circulation in a diseased organ, or disease of the vessels through increased permeability. Vascular paresis appears to be the source of the infiltration in cases occurring suddenly in healthy persons. Impediment to the circulation is found in connection with Bright's disease, of which it is a very frequent complication as a terminal manifestation of dropsy, septicæmia, pneumonia, and other infectious diseases. In the latter case the sputum is usually

more deeply blood-tinged than in the form due to renal trouble. It is also met with in grave anæmia, cerebral injuries, and valvular heart affections. Welch showed that œdema of the lungs could be produced by weakening the left ventricle. It may also occur as a result of hypostatic congestion; it is then termed "hypostatic œdema."

The transudation of serum may either be local (*i.e.*, limited to an area involved in an inflammatory process through which the vascular walls are weakened, and osmosis of the serum rendered possible) or general. In the latter type the transudation, serous or sero-sanguinolent, invades the tissues and alveoli, and the lung at autopsy is much heavier than the normal organ, and sinks in water.

Prognosis.—The prognosis of pulmonary œdema is grave in all cases in which it occurs as a complication, its gravity depending on that of the causative affection. In the so-called "idiopathic" cases, those occurring independently of any primary disease, the chances of recovery are much greater. The œdema following Bright's disease and pneumonia present a particularly unfavorable prognosis.

Treatment.—Œdema of the lungs being due in practically all cases to another disease, the treatment of the latter is the foundation of the measures to be adopted plus one very important indication: to sustain the heart by every means possible, heart-failure being the main cause of death. Caffeine, digitalis, and strychnine are the mainstays as far as remedies are concerned.

There are three elements in the production of acute œdema which have to be combated: First, the enormous pulmonary hypertension and the sudden or rapid enfeeblement of the right ventricle overcome by this hypertension; second, the troubles of innervation, cardio-pul-

monary; and, third, the very frequent renal impermeability.

To counteract the first, a large general bleeding to the amount of 10 or 12 ounces and injections of caffeine may be ordered. Against the second preparations of strychnine may be employed. On account of the third, a milk diet may be given, and theobromine ordered in doses of 20 to 40 grains a day. Huchard (*Gaz. des Hôp.*, Apr. 29, '97).

Derivatives are of value to relieve as much as possible the vascular engorgement. In the early stages a hot mustard foot-bath affords considerable relief, especially if coupled with the copious use of dry cups over the infiltrated area.

When the œdema shows signs of increase or when the case from the start assumes severe symptoms, venesection should at once be resorted to.

If the pulse is full and the heart acting vigorously, the spasm of the minute arterioles can be as readily relieved by nitroglycerin or morphine as by the depressing effect of the abstraction of blood. If the immediate origin of the trouble is the weakened muscle of the heart, showing its feebleness by frequent, irregular, and inefficient contractions, with a small and fluttering pulse, one should give at once under the skin $\frac{1}{100}$ grain (0.0006 gramme) of atropine sulphate, with $\frac{1}{50}$ grain (0.0012 gramme) of strychnine sulphate. This is to be inserted just below the clavicle in order to reach the heart with the least loss of time. While this is being absorbed attention can be given to preparations for venesection, if it should prove necessary. Atropine rapidly contracts the vessels, stimulates powerfully the sympathetic system, increases the force of the heart's beat, raises arterial tension, stimulates the respiratory centres, and dries up the secretions of the skin and mucous membranes. The dose required is whatever may be sufficient to produce its physiological effect, easily gauged by watching the amount of dilatation of the pupil. It is safe to begin with $\frac{1}{500}$ grain (0.00012 gramme), and repeat in a half-

hour or at longer intervals until the system is well under its influence. Charles O'Donovan (Amer. Medicine, Sept. 14, 1901).

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PULMONARY EMPHYSEMA.

Definition.—Pulmonary emphysema is characterized by the presence of an excess of air in the alveoli and infundibular passages, with atrophy of the alveolar walls, or by the adventitious presence of air in the interstitial alveolar tissue.

Varieties.—Emphysema is divided into two general varieties: the *vesicular*, in which the infundibular passages and alveoli are dilated, and the *interlobular*, in which the air has penetrated the interstitial alveolar tissue. The vesicular form is, in turn, subdivided into three varieties: the *substantive*, or *hypertrophic*, in which there is distension of the alveoli with atrophy of their walls, which gives rise to general enlargement of the lung; the *senile*, in which there is atrophy and shrinkage of the lung; and the *compensatory*, in which the air-cells of a part or the whole of one lung become enlarged so as to assume the functions and compensate for diseased portions of the opposite lung.

Vesicular Emphysema (Substantive, or Hypertrophic, Form).

Symptoms.—The onset and progress of emphysema are so insidious that the disease may be present a long time before it is recognized. Slight dyspnoea upon exertion is the first symptom usually noticed. This gradually increases in intensity until the feeling of suffocation is only absent when the patient is lying or sitting quietly; as soon, however, as he moves about, ascends stairs, etc., the dyspnoea appears. Under violent exertion and in advanced cases the dyspnoea may become exceedingly

severe and be attended by cyanosis. The latter, however, may not only attend a severe attack of dyspnoea, it is sometimes present while the patient is not in active motion. As the disease progresses, both the cyanosis and the dyspnoea become more marked. The patient, as a rule, experiences discomfort, not while inhaling, but while exhaling, wheezing and prolongation of the expiratory act suggesting asthma. The wheezing is not apt to be marked, however, unless catarrhal inflammation of the bronchial mucous membrane be also present. The labored breathing interferes with speech, and is a source of fatigue. The inspiration is sudden and jerky, while the expiration is prolonged and noisy. As the disease progresses, the dyspnoea becomes more distressing, and is aggravated by indiscretions in diet. Congestive disorders of the internal viscera, the liver, the intestine, the kidneys, and sometimes ascites may appear, followed, in turn, by emaciation and loss of strength.

Most important of all these associated disorders is bronchitis, which complicates the majority of cases. The attack may be mild and last but a short time and be attended by harassing cough, mucoid expectoration sometimes streaked with blood; or it may assume a more violent and continuous form, in which the cough and the dyspnoea, combined, so closely simulate an access of typical asthma as to mislead the medical attendant. The sputa are apt to be muco-purulent in such cases, and hæmoptyses suggesting the early signs of pulmonary tuberculosis are frequently observed. The slow progress of the major disease and the recurrence of the acute symptoms of bronchitis every winter, serve, however, to establish the diagnosis. During the summer emphysematous patients are sometimes sufficiently comfort-

able to lead to the belief that a complete cure has been effected. This form is frequently observed in young adults, whereas continuation of the emphysematous symptoms throughout the year, though characterized by exacerbations during the winter, is usually met with among old subjects. Cardiac symptoms often prevail, the result of hypertrophy followed by dilatation. These, in turn, are brought on by pulmonary congestion induced by the interference with circulation in the diseased areas.

Diagnosis.—Physical examination of advanced cases of emphysema renders a diagnosis comparatively easy in the majority of cases. The “barrel-chest,” having all its diameters, especially the antero-posterior, markedly increased; the prominent scapulæ and increased spinal curve and rounded back; the limited motion of the ribs, with unusually wide areas between them; and the prominent costal cartilages and sternum, below which the deep sternal fossa appears in striking contrast, are typical signs. The muscles of the thorax may be enlarged, and the thorax appear raised. The clavicles may stand out horizontally to an unusual degree, causing the head to sink deeper between the shoulders. In less advanced cases, however, the thoracic changes are, of course, less marked and the disease may have lasted a considerable time without giving rise to deformation of the chest. In all, however, and varying in degree with the progress of the disease, there is reduction of the relative expansion; the chest increasingly refuses to expand, notwithstanding the manifest muscular efforts which seem only to raise the entire chest upward. In truth, it is to inability to liberate imprisoned air that the reduced chest-expansion is due, the residual air being greatly in excess, and so filling the

emphysematous cavities as to prevent contraction of their walls. The resiliency of the latter is further impeded by the diseased condition of the alveolar structures. Mensuration shows that, while normal expansion reaches three to four inches, an emphysematous chest sometimes does not expand an inch; in rare cases no expansion can be noted. The impact of the heart is often lost, the organ being depressed or concealed by overlapping lung.

On auscultation, a marked feature of the disease is the difference between inspiration and expiration. While the former is feeble, sufficiently so sometimes as to be hardly audible, and shortened, the expiration is greatly prolonged, low in pitch, wheezy, and comparatively coarse, while, if bronchitis be a feature of the case, there are moist râles and other symptoms peculiar to this complication.

Percussion yields a peculiar drum-like note, the “band-box” tone of Biermer, especially marked over the emphysematous area. This sometimes so overlaps the cardiac area as to cause disappearance of the cardiac dullness, and sufficiently extend downward on the right side as to bring the upper margin of the hepatic dullness to a much lower level. Occasionally the splenic dullness is influenced in the same manner. Occasionally a net-work of dilated veins outlines the junction of the diaphragm to the anterior wall. Palpation enables the examiner to realize the diminished chest-expansion and the almost complete disappearance of the respiratory fremitus.

Prognosis.—The prognosis of emphysema is, as a rule, unfavorable when the disease is at all advanced. The local lesions progress steadily, though very slowly, and the patient is often carried

to his grave by intercurrent disorders, especially pneumonia. A heart disorder is almost always present as a direct result of the interference with the circulation, and dropsy and death may ensue from cardiac hypertrophy and distension. The disease is one of long duration; its progress may be stayed to a great extent by removal to a warm and equable climate, by proper hygienic surroundings, and general comfort.

Etiology.—Bronchitis, asthma, and, more rarely, pertussis are the main causes of pulmonary emphysema; to these factors may be added excessive and prolonged manual labor, playing on wind-instruments, glass-blowing, and other conditions inducing undue air-pressure within the pulmonary lobules. All these etiological factors bring on emphysema, however, only when the lung-tissue is congenitally weak. The nutritive changes in the air-cells play an important rôle in the production of the affection: a fact strongly sustained by “the markedly hereditary character of the disease and the frequency with which it starts early in life.” Osler lays special stress upon these two points, and refers to the observations of James Jackson, who, out of twenty-eight cases, studied under Louis’s direction, found that in eighteen one or both parents were affected. It is also observed in several members of one family. Asthma brings on emphysema by interfering with the exit of air. It may also be brought on by mitral disease as a result of the pulmonary congestion induced.

Two essential factors contributing to the enlargement of the chest in hypertrophic emphysema are defective pulmonary elasticity and dyspnoea. Mere loss of pulmonary elasticity, by inducing thoracic expansion, is sufficient to bring about emphysema. Diminution of the expiratory range is one of the

worst aspects of emphysema, and is brought about by fixation of the chest. The treatment should aim at preservation of the elasticity of the lungs, prevention of the overaction of the costal elevators, so as to check thoracic expansion, and maintenance of the normal mobility of the thorax. H. Campbell (*West London Med. Jour.*, p. 177, July, ’97).

Complete occlusion of the nares produces emphysema in a few days and changes the respiratory rhythm, the frequency of respiration being decreased and the depth of respirations being increased. A smaller quantity of air enters the lungs when the animals breathe only through the mouth than when the nose is used in respiration; hence it is fair to conclude that when nares were occluded the dogs were forced to take deeper inspirations in order to compensate for the diminished volume of air entering the lungs; pulmonary emphysema, therefore, depended in them upon the increased volume of respired air: a purely mechanical result of occlusion of the nares. Bullara (*Riforma Medica*, Nos. 183 and 184, 1900).

Pathology.—When the lungs are examined post-mortem, they are found to be greatly enlarged and devoid of elasticity. When cut, they are pale and occasionally show an absence of pigmentation: Virchow’s “albinian condition.”

Specimens of emphysematous lungs exhibited to the Berlin Medical Society, showing absence of pigmentation, termed by the author an albinian condition of the lung, sometimes found in post-mortems. Tubercles never found in a lung which was the seat of emphysema, and in only one instance pneumothorax found. Virchow (*Berl. klin. Woch.*, Jan. 2, ’88).

Emphysema and tuberculosis are sometimes co-existent. The former may succeed the latter or have preceded it. In the first case it is limited; in the latter it is often accompanied by chronic pneumonia. Potain (*La Sem. Méd.*, July 9, ’90).

The lung-tissue pits readily on pressure,—one of the most marked features,

according to Osler; and to the touch it conveys what he terms a "downy, feathery feel." The same author describes the morbid changes in the air-vesicles and bronchi as follows: "Beneath the pleura greatly-enlarged air-vesicles may be readily seen. They vary in size from $\frac{1}{2}$ to 3 millimetres; and irregular bullæ, the size of a walnut or larger, may project from the free margins. The best idea of the extreme rarefaction of the tissue is obtained from sections of a lung distended and dried. At the anterior margins the structure may form an irregular series of air-chambers, resembling the frog's lung. On careful inspection with the hand-lens, remnants of the interlobular septa or even of the alveoli may be seen on these large emphysematous vesicles. Though general throughout the organs, the distension is more marked, as a rule, at the anterior margins, and is often specially developed at the inner surface of the lobe near the root, where in extreme cases air-spaces as large as an egg may sometimes be found. Microscopically there is seen atrophy of the alveolar walls, by which is produced the coalescence of neighboring air-cells. In this process the capillary net-work disappears before the walls are completely atrophied. The loss of the elastic tissue is a special feature. It is stated, indeed, that in certain cases there is a congenital defect in the development of this tissue. The epithelium of the air-cells undergoes a fatty change, but the large distended air-spaces retain a pavement-layer.

"The bronchi show important changes. In the larger tubes the mucous membrane may be rough and thickened from chronic bronchitis; often the longitudinal lines of submucous elastic tissue stand out prominently. In the advanced

cases many of the smaller tubes are dilated, particularly when, in addition to emphysema, there are peribronchial fibroid changes. Bronchiectasis is not, however, an invariable accompaniment of emphysema, but, as Laennec remarks, it is difficult to understand why it is not more common. Of associated morbid changes, the most important are found in the heart. The right chambers are dilated and hypertrophied, the tricuspid orifice is large, and the valve-segments are often thickened at the edges. In advanced cases the cardiac hypertrophy is general. The pulmonary artery and its branches may be wide and show marked atheromatous changes."

Treatment.—As already stated, change of residence to an equable and warm climate is of great value, especially in cases characterized by bronchitis and asthma. Any stenotic disorder of the naso-pharynx should be corrected and the patient should give careful attention to the bowels and receive nutritious, though easily digested, food. While no remedy is known to greatly influence the disease, much may be done to relieve the patient's discomfort. Pressure upon the abdomen by means of an abdominal belt is sometimes helpful (Berdez). Oxygen inhalations are also of great value, 2 or 3 gallons being administered three times a day (Reid, Skerrit). As an internal remedy, none is better than strychnine, the dose being gradually increased. Urgent dyspnoea and lividity occurring in young and vigorous subjects are bled by Osler, who states that he has saved lives in so doing. Aspiration of the air in large cavities has been used with success by Wigmore.

When the heart begins to fail, rest in bed is required, and, if this does not overcome the œdema, digitalis should be given. Three to 4 $\frac{1}{2}$ grains of the pow-

der, preferably in the infusion, are given the first day, and continued until two quarts of urine are passed in twenty-four hours, or until the action of the drug is indicated in the pulse (Liebermeister).

Continuous aspiration drainage recommended. This method was first recommended by Buleau, but Perthes deserves the credit for establishing this form of drainage as a satisfactory treatment. The writer reports two cases in which he made continuous aspiration drainage after the method of Perthes, and he presents the illustrations of an improvised apparatus in a private house. In both the cases reported the result of the treatment was most satisfactory. Weller Van Hook (*Jour. Amer. Med. Assoc.*, May 30, 1903).

Senile, or Atrophic, Emphysema.—In this form of vesicular emphysema, carefully studied by Jenner, the alveolar septa become atrophied and large air-spaces are formed; the atrophy being general, though irregularly progressive, the organ becomes reduced in size, thus constituting "small-lunged emphysema" of Jenner; and contraction of the chest-wall—which is not always perceptible—constitute about all the symptoms, and even these are usually hidden by those of catarrhal tracheo-bronchitis, from which these patients almost always suffer. As implied by its name, the disease is one of old age.

TREATMENT.—The treatment of this condition is symptomatic, though measures indicated in chronic bronchitis are often beneficial. Strychnine is a valuable tonic, especially when the hygienic indications recommended in the treatment of the hypertrophic form can also be carried out.

Compensatory Emphysema.—As its name indicates, this form of emphysema is compensative; it affords an increase in the respiratory capacity in various parts of the lung to make up for that

lost in other parts through local disease, especially tuberculosis, lobular pneumonia, pleurisy, and extensive pleural adhesions. Tuberculous areas and cavities or cicatricial masses occupying formerly diseased spots, especially when situated near the peripheral parts of the organ, are almost always surrounded by areas of distended air-vesicles. The opposite lung may also and often does assume vicarious distension to compensate for the loss of respiratory area in an extensively-diseased lung. This occurs especially in cases of pulmonary fibrosis and tuberculosis.

Whether the compensation is truly such—*i.e.*, a provision of Nature to prolong life through vicarious continuation of a physiological process—or whether the vesicular dilatation merely occurs as the result of the increased pressure resulting from restriction of air-space elsewhere cannot be determined. Both features of the process seem, however, to be involved concurrently. At first the dilated alveolar walls remain histologically normal, but, when the case is advanced, atrophy becomes manifest and the lesions of true emphysema are to be found.

Interlobular Emphysema.—This form of emphysema is due to the escape of air into the interlobular connective tissue, and thence in a large proportion of cases to adjoining structures. It is usually brought on by injuries of the lung-tissue, during which the latter is punctured or torn. It may also be caused by excessive effort, in which the diaphragm exerts pressure upon the lungs, as during the act of "bearing down" in parturition, defecation, violent coughing, etc. In all such cases there is also, doubtless, a congenital weakness of the pulmonary tissues.

The air-cavities thus formed vary in

size from that of a pea to that of an egg. At times, rupture occurs at the junction between the lung and the trachea, the air penetrating the subcutaneous areolar tissue of the neck and sometimes far beyond this region.

Half an hour after being run over by a wagon, a robust, 8-year-old boy was found to be suffering from emphysema, extending over the whole body except the palms and soles. Penis and scrotum were so puffed up as to resemble oblong rubber balls, and an attempt to hold the eyelids open with adhesive straps proved unavailing because of the tense state of the skin. The tissues under the scalp were also involved, crackling being distinctly perceived. The skin of the whole body was tense and pale. There were slight contusions on the elbow and chest. Respiration was labored. Palpation disclosed fractures of the sternum and second right rib. Three hours later the emphysema had so increased as materially to interfere with respiration; skin stretched almost to the limit of its elasticity; increasing cyanosis. On incising the chest the effect was instantaneous, as if a tense rubber ball had been pricked, and breathing immediately became deeper and slower. Two rubber drainage-tubes were inserted and left in for five days. Next day a pneumonia jacket was applied, after which the treatment was expectant and symptomatic, the only complication being a mild localized pleurisy and hæmoptysis. The pneumothorax had practically disappeared on the sixth day, by expulsion rather than by absorption. The air in the tissues was absorbed so slowly that it could still be detected therein eighteen days afterward. C. G. Molin (Brooklyn Med. Jour., Oct., '97).

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PYÆMIA. See WOUNDS (SEPTIC)
AND GANGRENE.

PYRIDIN.—Pyridin is a basic substance obtained by dry distillation of

organic compounds containing nitrogen (bone-oil, coal-tar, naphtha, etc.). It occurs as a colorless, limpid, hygroscopical liquid, having an empyreumatic odor and a sharp taste, and freely miscible with water, alcohol, ether, chloroform, benzin, and the fatty oils. Pyridin forms salts with the acids. The dose of pyridin for internal administration is 2 to 10 drops in water, several times daily. By inhalation, 45 to 75 minims placed in a saucer may be evaporated spontaneously in a room, or 5 to 20 drops in 2 ounces of water may be inhaled from an atomizer, or 3 to 5 drops directly.

Physiological Action.—According to Blanc, pyridin, if inhaled in small dose, produces slight somnolence, headache (with congestion of the face), and sometimes a little vertigo. The inspiration acquires a remarkable amplitude, the blood-pressure diminishes, and there is a general vasodilatation. The excitomotor power of the medulla and spinal cord is profoundly changed, their excitability being calmed. The bronchial secretion is somewhat increased. Absorption of pyridin by the air-passages is rapid and elimination by the urine almost equally so, being complete within fifteen minutes; it is also eliminated by the lungs and the glandular apparatus of the digestive tract, thus increasing the gastric secretion, exciting the appetite, and favoring digestion. This rapid elimination permits the use of large doses with safety.

Therapeutics.—Pyridin was introduced by Germain Sée as a remedy for the relief of bronchial asthma. One drachm of pyridin is left to evaporate spontaneously from a plate placed in the patient's room. At a temperature of 68°-77° F. this quantity will evaporate in about one hour.

Angina pectoris is said to be relieved by the internal use of 5 to 10 minims daily, increased to 25 minims daily.

De Renzi found pyridin an excellent heart-stimulant in doses of 6 to 10 drops,—in water, per day,—increased to 25 drops. It was as well borne as digitalis, and acted better in asystolic conditions.

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PYROGALLOL.—Pyrogallol (U. S. P.), or pyrogallic acid, is a triatomic phenol, obtained chiefly by the dry distillation of gallic acid. It occurs in white, lustrous, odorless, scales or needles, having a bitter taste and soluble in $2\frac{1}{2}$ parts of water, in alcohol, and in ether. It is a strong reducing agent, to which property it largely owes its therapeutic effects. It darkens on exposure to light. Its watery solutions, or even the moistened crystals, in contact with the air, absorb oxygen and acquire a brown color; the reaction of the fluid also changes from neutral to acid. The color-change takes place more rapidly if a caustic alkali is present in the solution. It is not administered internally. It is used externally in ointment and in powder (10 to 20 per cent.). The stronger ointments have a caustic effect. Pyrogallol possesses antiseptic properties.

Poisoning by Pyrogallol.—The incautious application of pyrogallol may cause inflammation of the skin up to the point of ulceration and sloughing. Fatal intoxication has followed the inunction of one-half the body with a 10-per-cent. ointment, the surface being afterward covered by gutta-percha tissue and a bandage (Neisser). The symptoms began within two hours, with rigors, diarrhœa, vomiting, and strangury. The next day the urine was very dark colored

(hæmoglobinuria); all the symptoms became aggravated, with apathy, dyspnœa, exaggerated reflexes, and collapse, followed by death two days later.

Severe case of poisoning from pyrogallic acid which was employed in ointment form for psoriasis. The patient was a pregnant woman, and, although recovery took place, abortion occurred. Hæmaturia and hæmoglobinuria were absent, although the urine was, as usual, of a dark brown color. The pregnant state seems to increase the susceptibility to pyrogallol poisoning. Rusch (Wien. klin. Woch., No. 52, 1901).

Treatment of Poisoning by Pyrogallol.

—On the first appearance of gastro-intestinal disturbance, strangury, or smoky urine, the remedy should be at once discontinued. Neisser suggests, further, the subcutaneous injections of ether, alcoholics frequently repeated, energetic stimulation of the surfaces, and the inhalation of oxygen. The mineral acids act as antidotes.

Therapeutics.—Pyrogallol was introduced in 1878 by Jarisch as a remedy in psoriasis and lupus. It has since been shown to be of value in parasitic diseases, as eczema marginatum, in epithelioma, in simple chancre, and in phagedæna. Unfortunately, it stains the skin, hair, and nails, as well as linen apparel with which it comes in contact.

In psoriasis a 10- to 15-per-cent. ointment is thoroughly rubbed into the affected areas. In lupus pyrogallol acts upon the diseased tissues as a mild escharotic. The rapidity of its action is increased when the epidermis is intact by first applying a moderately-strong solution of caustic potash. A 10- to 20-per-cent. ointment is applied on lint, and covered with a piece of gutta-percha tissue, which may be made to adhere to

the skin by moistening its edges with chloroform. The applications are renewed daily, for two to seven days, until the lupus patch has been converted into a gray, pultaceous mass. Iodoform ointment or a mercurial plaster is then applied. This treatment is applied at intervals so long as any lupus tubercles are visible.

In lupus Besnier has used a saturated solution of pyrogallol in ether, which he brushes over the lupus patch and covers with traumaticin. Brocq prefers a solution of pyrogallol with salicylic acid (10 per cent. of each) in collodion.

In tuberculous processes affected tissues destroyed with ointment composed of vaselin containing 10 per cent. of pyrogallol; this is spread on lint and applied to the part for three to five days. Wound so produced is then allowed to heal, being dressed with a vaselin oint-

ment containing from $\frac{1}{2}$ to 2 per cent. of pyrogallol. Cases of tuberculosis of the skin, even when extending deeply, treated in this way; and results have been good. It is necessary to keep a close watch on the urine of the patients, to prevent poisoning by the absorption of the pyrogallol. Veiel (*Archiv f. Derm. u. Syph.*, B. 44, '98).

Epithelioma is treated in the same way as lupus. In simple chancre Vidal used a 25-per-cent. ointment and for phagedæna a powder of pyrogallol and starch (1 to 4).

In epithelioma of the skin one of the best caustics is pyrogallic acid. Its action is slow, it is easy to regulate the amount of destruction, and the drug is less painful than others of the same class. When a deep action from the drug is desired, the eschar must be removed with poultices from time to time, and the remedy reapplied. Hartzell (*Ther. Gaz.*, Nov. 15, '94).

Q

QUASSIA.—Quassia (U. S. P.) is the wood of *Picræna excelsa*, Lindley (nat. ord., *Simarubæ*): a large tree indigenous to Jamaica and other parts of the West Indies. It occurs usually in the form of small chips or raspings, nearly white in color, odorless, but very bitter. The wood is sometimes turned into cups, which are used by pouring hot water into them, and allowing it to remain for several hours; the water becomes quite bitter, having absorbed the bitter principle from the wooden cup. Quassia contains a bitter, neutral principle, quassin (quassiin), which occurs in white, opaque, intensely-bitter crystals; is soluble in alcohol, hot water, and chloroform and slightly soluble in cold water. It also contains a minute quantity of a volatile oil, but no tannin. The fluid extract is an alcoholic preparation. The

tincture of the present pharmacopœia (1890) is 50-per-cent. stronger than of the former one (1880).

Preparations and Doses.—Quassia (U. S. P.).

Extractum quassiae, U. S. P. (solid aqueous extract), 1 to 3 grains.

Extractum quassiae fluidum, U. S. P. (fluid extract), 5 to 30 minims.

Tinctura quassiae (U. S. P.), $\frac{1}{2}$ to 2 drachms.

Infusum quassiae, B. P. (infusion, 1 drachm to 10 ounces), $\frac{1}{2}$ to 2 ounces.

Quassin (neutral principle, not official), $\frac{1}{32}$ to $\frac{1}{2}$ grain.

Poisoning by Quassia.—Taken in overdose, quassia acts as an irritant of the mucous membrane of the stomach and as a nauseant. Potter reports serious symptoms of narcotism from quassia in a child of four years. In dose of

about $\frac{1}{4}$ grain Campardon found quassin to produce severe headache, severe burning pain in the throat and œsophagus, nausea, vertigo, restlessness, diarrhœa, and frequent passage, but diminished secretion of urine.

F. Venn, of Chicago, reported a fatal case of poisoning from a decoction of 2 ounces of quassia injected into the rectum of a child for the treatment of seat-worms (Univ. Med. Mag., Jan., '95).

Therapeutics. — Quassia is a simple bitter without astringency, and has been found useful in convalescence from acute fevers to increase the appetite and improve the digestion. In atony of the stomach, or simple dyspepsia with eructations after meals, the administration of quassia is followed by good results. It is used in diarrhœa from indigestion and as a stomachic in malarial affections. An infusion of quassia (1 to 2 ounces to the pint of boiling water) as a reliable remedy, given as an enema, to destroy thread-worms (*ascarides*) in children. Before giving the enema ($\frac{1}{2}$ ounce to 1 pint) the bowel should be well washed out by injections of soap and water. The enema should be retained for some minutes.

QUEBRACHO. — Quebracho, or *aspidosperma* (U. S. P.), is the bark of the *Aspidosperma quebracho blanco* (nat. ord., *Apocynaceæ*): a large tree indigenous to Brazil and Catamarea (Argentine Republic). It contains 5 alkaloids: aspidospermatine, aspidosamine, quebrachine, hypoquebrachine, and quebrachamine. Quebrachine is the most commonly employed. Aspidospermine, an impure mixture of the alkaloids (G. Bardet), may be had as a fluid extract or as a solid extract.

Aspidospermine (Hesse-Merck) occurs as a yellowish-brown amorphous powder,

which darkens upon exposure; is soluble in alcohol, ether, chloroform, and benzole; and is given in doses of from 1 to 2 grains.

Aspidospermine (Fraude-Merck) occurs in needle or in pointed prismatic crystals, which are soluble in alcohol, ether, chloroform, and benzole, and is given in doses of from $\frac{1}{3}$ to 1 grain. The citrate, hydrochlorate, and sulphate are soluble in water and alcohol.

Quebrachine occurs in colorless to yellowish crystals, which darken upon exposure, have a bitter taste, are soluble in chloroform, hot alcohol, hot ether, and amyl-alcohol. It is given in doses of from 1 to 2 grains. The hydrochlorate occurs in white crystals soluble in water and in alcohol.

Hypoquebrachine occurs as a yellow, or brown, amorphous, bitter powder; it agglutinates in masses and is soluble in alcohol, ether, and chloroform. The hydrochlorate occurs as a yellow powder, soluble in water and in alcohol.

Quebrachamine occurs in white, bitter crystals or scales, which are slightly soluble in alcohol, ether, and chloroform. The sulphate occurs in white crystals, soluble in water and in alcohol.

Preparations and Doses. — Aspidosperma, U. S. P. (the crude drug), 5 to 30 grains.

Extractum aspidospermatis fluidum, U. S. P. (fluid extract), 5 to 30 minims.

Aspidospermine (amorphous) and salts, 1 to 2 grains.

Aspidospermine (crystalline) and salts, $\frac{1}{2}$ to 1 grain.

Quebrachine and salts, $\frac{1}{2}$ to 2 grains.

Tinctura aspidospermatis (40 to 50 per cent.), 5 to 10 minims.

Vinum aspidospermatis (6 per cent.), $\frac{1}{2}$ to 1 drachm.

Poisoning by Quebracho and Physiological Action. — In toxic doses que-

bracho causes salivation, paralysis of respiration, and diminished action of the heart and convulsions; death is caused by paralysis of the respiratory centre. After prolonged medicinal use quebracho appears to cause a disturbance of the sympathetic nervous system. The blood of animals poisoned by quebracho becomes red. Bardet found that it distinctly increases the depth of the respiratory movements, retards the pulse (contrary to Penzoldt's view), and causes a fall in the temperature.

Therapeutics.—**FEVERS.**—Huchard has pointed out the antithermic properties of quebracho. He believes that the antithermic properties reside principally in quebrachine, which may be given in doses of from $\frac{1}{2}$ to 2 grains.

In acute rheumatism and in inflammation of the serous membranes quebracho very sensibly diminishes the pulse-rate and the temperature.

The alkaloid aspidospermine has been employed as a febrifuge in malarial and other fevers, and, according to Guttman, its dose as an antiperiodic is 18 grains (?), the ordinary dose being 1 or 2 grains.

DYSPNŒA.—Quebracho has been recommended as a remedy for the relief of dyspnœa of all kinds, whether bronchial, cardiac, or nervous.

In asthma accompanied by emphysema, even in the presence of pleurisy or bronchitis, Penzoldt finds that the dyspnœa is relieved by the fluid extract given in doses of 20 to 40 minims several times daily. He also advises its use in bronchial asthma and cardiac asthma (where compensation is well established, but not when due to a weak, diseased heart).

Flint recommends this drug in dyspnœa from mitral insufficiency, and in all kinds of dyspnœa in the absence of other organic disease.

In a case of double pneumonia in a child Lawrence witnessed decided improvement of the respiration and circulation following the use of this remedy.

E. M. Hale calls quebracho and its alkaloid aspidospermine "the digitalis of the lungs." He has used it successfully in most cases in which dyspnœa was a marked symptom. As small a dose as $\frac{1}{500}$ to $\frac{1}{100}$ grain of aspidospermine acts well in asthma and in spasmodic croup.

Huchard claims that dyspnœa is relieved only by the pure aspidospermine, which is the least toxic of all the active principles of quebracho. Bouchard has found aspidospermine valuable in the treatment of all varieties of functional dyspnœa, in doses of from $\frac{1}{4}$ to 1 grain. The alkaloid or its salts may be given hypodermically; the citrate, hydrochlorate, and sulphate are soluble in water. He advises a solution (1 to 60) of the alkaloid, and gives 15 minims ($\frac{1}{4}$ grain).

DYSENTERY.—Bourdeaux has used the fluid extract, in doses of from 20 to 30 drops, in cases of dysentery, with great relief. Enemata of the fluid extract (1 or 2 drachms to the pint of water) may be used for its topical effect, as it is both astringent and antiseptic.

TOPICAL USES.—Bourdeaux has found the topical application of the fluid extract (alcoholic) of quebracho, diluted with water, an energetic astringent and an aid to cicatrization. On fresh wounds with smooth edges it causes slight pain and stimulation, and induces healing by first intention. Its action is just as favorable in burns and frost-bites, if the ulcers present a rosy aspect. In crushed and lacerated wounds healing takes place, without the formation of pus, after a few applications. It is also a useful injection in endometritis and ulceration of the cervix uteri, a teaspoonful of the

extract being added to a cup of water for this purpose.

QUININE (see also CINCHONA).—Quinine, or quinina (U. S. P.), is an alkaloid obtained from the bark of various species of cinchona. It occurs as a bulky, white, amorphous, or crystalline powder, having a very bitter taste. It is soluble in ether, chloroform, benzene (benzole), carbon disulphide, benzin, oils, in 6 parts of alcohol, in 200 parts of glycerin, and in 1960 parts of water. It forms salts with the acids, of which the bisulphate, hydrobromate, hydrochlorate, sulphate, and valerianate are official. The salts of quinine are usually prescribed. For hypodermic use, the bisulphate, carbamidated bimuriate, ethylsulphate, hydrobromate, or quinate is to be preferred, although the hydrochlorate or sulphate may be used.

Quinine bisulphate, or acid sulphate of quinine, occurs in colorless, lustrous crystals, which effloresce rapidly and become opaque upon exposure to the air. It is soluble in 10 parts of water and in 32 parts of alcohol.

Quinine hydrobromate occurs in silky, white, light needles, which are soluble in 0.6 part of alcohol, 6 parts of ether, 12 parts of chloroform, and 54 parts of water.

Quinine hydrochlorate, or muriate, occurs in white, silky needles, which are soluble in 3 parts of alcohol, 9 parts of chloroform, and 34 parts of water at 59° F.

Quinine and urea hydrochlorate, or carbamidated bimuriate, occurs in clear, colorless crystals, soluble in water and in alcohol. It is used in 50-per-cent. solution for hypodermic injection. Dose, 1 1/2 to 8 grains.

Quinine salicylate occurs in fine, white, bitter crystals, soluble in 20 parts of

alcohol, 120 parts of ether, and 225 parts of water. It is used as an intestinal antiseptic and in rheumatic affections. Dose, 2 to 30 grains.

Quinine sulphate occurs in white, lustrous, or shining, easily compressible, fragile needles, which are very bitter, absorb moisture from damp air, and darken in the light. The sulphate is soluble in dilute acids, in 3 parts of boiling alcohol, 50 parts of boiling water, 40 parts of glycerin, 65 parts of alcohol; and in 740 parts of water and 680 parts of chloroform at 59° F.

Quinine ethyl-sulphate, sulphovinate or sulpho-ethylate, occurs in white crystals, containing 71 per cent. of quinine, and soluble in 3 parts of water. Dose, 3 to 8 grains.

Quinine quinate occurs in white crystals of very bitter taste, soluble in water and alcohol. Dose, 1 to 30 grains.

Quinine valerianate occurs in lustrous, white, or almost white, triclinic crystals, which have a bitter taste and a slight odor of valerian. The valerianate is soluble in 5 parts of alcohol, and 100 parts of water at 59° F.

Quinine tannate occurs as a light-brown, tasteless powder, slightly soluble in alcohol. It is less active than the more soluble salts, but is preferred for children, because it is tasteless. Dose, 1 to 10 grains.

Warburg's tincture is a combination of quinine with aromatics; each ounce contains 10 grains of quinine.

(For the description and uses of quineum, quinidine and salts, quinoidine and salts, quinoline, quinic or kinic acid, quinolinic, quinopicric, and quinovic acids, see CINCHONA, volume ii.)

Preparations and Doses.—Quinina (U. S. P.), 1 to 30 grains.

Ferri et quininae citras (U. S. P.), 3 to 10 grains.

Ferri et quininæ citras solubilis (U. S. P.), 3 to 10 grains.

Vinum ferri amarum (U. S. P.), 1 to 3 drachms.

Quininæ bisulphas (U. S. P.), 1 to 30 grains.

Quininæ hydrobromas (U. S. P.), 1 to 30 grains.

Quininæ hydrochloras (U. S. P.), 1 to 30 grains.

Quininæ sulphas (U. S. P.), 1 to 30 grains.

Syrupus ferri, quininæ, et strychninæ phosphatum (U. S. P.), $\frac{1}{2}$ to 1 drachm.

Quininæ valerianas (U. S. P.), 1 to 6 grains.

Administration of Quinine.—*Incompatibles.*—Quinine is incompatible with ammonia, alkalies, lime-water, tannic acid, Donovan's solution, iodine, potassium iodide, etc.

Contra-indications.—Quinine is contra-indicated in acute gastritis, acute cystitis, congestion of the kidneys, meningitis, cerebritis, epilepsy, middle-ear disease, and in infantile eczema, because it congests, irritates, or stimulates those areas which are diseased. It is also contra-indicated in those cases which have an idiosyncrasy to its action, where nervous disturbance, cephalalgia, skin eruption, or purpura is caused by small doses, and where these cannot be overcome by the use of the bromides, ergot, and arsenic.

METHODS.—Quinine is seldom given in solution on account of its disagreeable taste, but generally in capsules, gelatin- or sugar-coated pills, or in cachets; if given in a coated pill, the gelatin coating should be thin and the sugar unhardened by age. Quinine in powder may be taken in a dessertspoonful of syrup of red orange or syrup of wild cherry or in a little whisky and water. Quinine may be taken in cascara

cordial or in aromatic syrup of yerba santa. Quinine rubbed up with one-fourth its weight of ammoniated glycyrrhizin is practically tasteless of quinine. Abraham Jacobi suggested that quinine be mixed in a tablespoon with enough strong, black coffee, cold, to almost fill the spoon. In young children or delicate persons with delicate stomachs one of the following mixtures will be found palatable: Sulphate of quinine, 16 grains; fluid extract of licorice, 1 drachm; syrup of orange-peel, 2 ounces; a teaspoonful three times a day, for a child of three years. Quinine sulphate, 24 grains; ammoniated elixir of glycyrrhizin, 3 ounces; 1 to 4 teaspoonfuls as required. Quinine chocolates, each containing 1 grain of the tannate (itself almost tasteless), are an eligible preparation for children. An extemporaneous tannate may be prepared by either of the following formulæ: 1. Quinine (alkaloid), 24 grains; tannic acid, 12 grains; syrup of cinnamon, 3 ounces; 1 teaspoonful contains 1 grain of quinine; if the sulphate of quinine is used, the amount of tannic acid must be doubled. 2. Muriate of quinine, 24 grains; tannic acid and ammoniated glycyrrhizin, of each, 12 grains; divide into 12 powders.

Quinine may be given in suppositories. For children, 2 or 3 grains of the hydrochlorate are combined with 15 grains of cacao-butter; for adults, 10 to 25 grains may be combined with 60 to 90 grains of cacao-butter. Quinine suppositories are apt to cause irritation of the rectum if their use is prolonged, and are therefore not recommended except in special cases, for temporary use, or in an emergency.

Hypodermic Use.—The hydrochlorate dissolved in 10 parts of water contains more alkaloid than the same solution of the bisulphate. Solutions of the hydrochlorate: 1. Quinine hydrochlorate, 7

grains; glycerin and water, of each, $\frac{1}{2}$ drachm; warm the solution before using and do not add acid. 2. Quinine hydrochlorate, 15 grains; alcohol, 15 minims; distilled water, $1\frac{1}{2}$ drachms, add a few drops of hydrochloric acid to complete the solution before using.

For hypodermic use, quinine hydrochlorate is superior to all other soluble salts of quinine, since $15\frac{1}{2}$ minims contain $7\frac{1}{2}$ grains of the salt. It contains the same quantity of quinine as the sulphate, while, being much more dense, the same doses are much smaller in size and can be administered in very small wafers. It possesses, in the highest degree, the physiological and therapeutic properties of the quinine salts. Grimaux and Laborde (*Comptes-rendus Heb. des Séances et Mém. de la Soc. de Biol.*, Oct., '92).

Following formula for the hypodermic administration of quinine recommended: Hydrobromate or hydrochlorate of quinine, 15 grains; urethane, $7\frac{1}{2}$ grains; warm water 15 minims. Make a solution by aid of heat if necessary. About 30 minims are obtained of a permanent solution, which does not precipitate on cooling, has only a weak reaction, and is absolutely non-irritating. G. Gaglia (*La Sem. Méd.*, June 1, '98).

For subcutaneous injection of quinine, solution which causes hardly any pain and does not give rise to inflammation is as follows: Thirty grains of quinine hydrochloride are dissolved in $2\frac{1}{2}$ drachms of distilled water in a test-tube with the aid of moderate heat. Reaction must be alkaline. Cooled to below 89.6° F., this solution becomes a rather firm mass, but it readily liquefies on being warmed. Von Stoffella (*Wiener klin. Rund.*, No. 1, '98).

The hydrochlorate of quinine dissolves readily in boiling water and it does not crystallize out of this water when cooled to body-temperature. This is especially useful for its hypodermic use. It is important to pass the needle beneath, and not merely into, the skin. The solution may be thoroughly boiled to insure asepsis. The injections when properly made cause no pain, indurations, or

other unpleasant results. Bluenchen (*Deutsche med. Wochen.*, April 25, 1901).

The following preparation of quinine recommended for subcutaneous injection:—

R̄ Quininæ hydrochloratis, $7\frac{1}{2}$ grains.

Urethania, $3\frac{3}{4}$ grains.

Aquæ distillatæ, 75 minims.

Urethane increases the solubility of quinine, and hence its use does away with the necessity of injecting large quantities of fluid into the tissues. The writer obtains as good results from the use of the above solution as with a simple solution of quinine in 34 parts of distilled water. Aufrecht (*Therap. Monats.*, Feb., 1903).

If the bisulphate is used hypodermically, add a little tartaric or sulphuric acid, to prevent precipitation of the drug in the alkaline juices of the connective tissue, before it can be absorbed: 1 grain of tartaric acid to each 5 grains of bisulphate of quinine. Lente's solution of the bisulphate is as follows: Quinine bisulphate, 50 grains; dilute sulphuric acid, 100 minims; water, 1 ounce; dissolve with heat, filter, and add 5 minims of carbolic acid.

If the sulphate is used: Quinine sulphate, 10 grains; water, 1 drachm; sulphuric acid, drop by drop until solution is perfected. Bartholow's formula is: Quinine sulphate, 1 drachm; morphine sulphate, $\frac{1}{2}$ grain; dilute sulphuric acid, 40 minims; distilled water, 1 ounce; mix and filter; 60 minims equal $7\frac{1}{2}$ grains of quinine.

The hydrobromate (soluble 1 in 54), the carbamidated bimuriate (one-half as strong in quinine as the other salts; is used in 50-per-cent. solution), the sulphovinate (ethyl-sulphate; soluble 1 in 3), or the quinate may be used by the hypodermic injection.

The usual dose by hypodermic injection is from $1\frac{1}{2}$ to 8 grains. The best place to inject quinine solutions is in the buttock, between the trochanter and

the tuber ischii. Injections of this drug into the calf of the leg are very painful.

In using quinine for hypodermic injections certain precautions should be taken: the solution should not be too strong, a part of the body should be chosen where the cellular tissue is abundant, the syringe and needle should be made aseptic by boiling in water, and the injection should be made slowly. Kelsch (Arch. de Méd. et de Pharm. Mil., Feb., '95).

Intravenous Injections.—Bacelli has suggested the intravenous injection of quinine solutions in pressing cases of malarial infection. The solution used is as follows: Quinine hydrochlorate, 15 grains; chloride of sodium, 15 grains; distilled water, 2 $\frac{1}{2}$ drachms. This solution, after adding distilled water, should be boiled and filtered before using, and should be used while warm, and injected very slowly, as quinine in concentrated form is a powerful depressant of the heart. As we have other rapid, efficient, and comparatively safe methods of introducing quinine into the system at our command, this one cannot be recommended.

Physiological Action.—The influence of quinine upon the vital processes in general is a depressing one, if the ratio of waste-products is to be taken as a guide. The elimination of nitrogenous products is especially reduced. Upon the blood the effects vary according to the mode of administration, the influence upon the corpuscles being much greater when the salts are given hypodermically. The migration of leucocytes through the vascular walls is, to a degree, inhibited by large doses, during an inflammatory process. When given in anæmic conditions, the red corpuscles are increased in number, sometimes very markedly. On the other hand, the presence of quinine in the blood increases the action of heat upon these elements. Leucocytes, for in-

stance, which continue active at 107° F. rapidly lost their activity when large doses of quinine are administered. Toxic doses for the organism are the same as those which are fatal to the leucocytes: 1 grain for every 3 $\frac{1}{3}$ ounces of blood (Maurel). After a malarial febrile crisis it causes marked reduction of temperature; in other fevers it also—though not always—acts as an antipyretic; but its propensity to produce cerebral congestion renders other antipyretics preferable.

As to digestion, the experiments of Büdin have shown that the hydrochlorate does not retard it, while the sulphate of quinine does. Both of these salts in large amounts increase the acidity of the gastric juice and the absorptive power of the stomach. Process of peptonization of proteids and the energy of the rennet ferment is not affected. One-half of this amount exerted a similar action upon the gastric function, though the effects were less constant and pronounced. The pernicious effects of quinine upon the stomach are avoided, when moderate doses are used, by administering it *during* a meal.

Quinine is a cerebral stimulant, but if administered in large doses it induces congestion. The dizziness, tinnitus, "roaring," and intense headache complained of are due to this cause. Unconsciousness is sometimes observed.

Case of man who took about 40 grains of quinine for malaria. In an hour he became unconscious, pallid, with cold surface. The pulse and respirations were feeble and rapid. Camphor and ether injections aroused him in another hour, but he could not see. He then slept for eight or nine hours. On awakening his sight still troubled him, but he recovered from this rapidly and went to work the next day. He complained of no tinnitus or deafness at any time. Grosskopf (Ther. Monats., Oct., '92).

Large doses depress the spinal centres, while small ones merely reduce the reflex

activity by stimulating the reflex inhibitory centres.

The essential features of the disorders of vision due to quinine are mainly the result of pronounced contraction of the retinal arteries and veins and a decided fullness of the capillaries of the optic disk as a permanent condition (Gruening). According to de Schweinitz, the lesion in quinine amaurosis is peripheral: Primarily, there is ischæmia of the retinal and optic nerve-vessels, caused by their intense contraction; if the blindness continue for a sufficient length of time, atrophy of the optic nerve and tract associated with vascular changes indicating vasculitis and endovasculitis ensue, followed ultimately by obliteration of the lumen of the vessels.

Incomplete ocular cinchonism is not rare, and in an hour after 20 grains of quinine have been taken some accommodation paresis may be noticed in a good percentage of cases, as was noted in a case mentioned. J. C. Clemesha (Buffalo Med. Jour., Nov., '98).

Study of the pathological changes produced by injecting quinine hypodermically in dogs. Although the arteries were constricted, no histological changes were noticed in vessels of the nerve or retina, there being neither thickening of the vessel-walls nor proliferation of the endothelium. The pathological process consists in a constriction of the retinal vessels, and particularly of the arteries, followed by a highly-albuminous serous exudation into the nerve-fibre layer, and a degeneration of the ganglion-cells, together with their axis-cylinder processes, which become the centripetal fibres of the optic nerve. Holden (Archives of Ophthal., Nov., '98).

Case of a major in the United States Army to whom quinine was prescribed in five 1-grain pills, one to be taken every hour, in spite of the patient's assertion that he couldn't stand quinine at all. In three hours grippal pains set in, facial erythema of erysipelatous character, signs of physical collapse, and mental de-

lirium followed. The effects lasted about four weeks. F. W. Bock (Merck's Archives, Aug., 1900).

In the diagnosis of quinine rashes two points are of especial interest: the involvement of mucous membranes and desquamation. In 14 of 61 cases reported there was desquamation, and in 11 of the 14 the mucous membranes were involved. These facts bring scarlet fever into the question of diagnosis. The most potent cause is idiosyncrasy,—age, sex, size of dose, etc., having little bearing on the production. Treatment is symptomatic. When the idiosyncrasy is known the drug should be given hypodermically. H. C. Wood, Jr. (Medical News, Nov. 23, 1901).

The differential diagnosis between scarlet fever and quinine rash should be based on (1) the history of exposure to scarlet fever; (2) the greater intensity of constitutional disturbance in scarlet fever; (3) the desquamation in quinine rash is not so persistent; (4) there is not that peculiar desquamation of the fingers, especially around the nails, in quinine rash; (5) there are not the enlarged tonsils covered by a yellowish exudate, as in scarlet fever; (6) there is not apt to be the strawberry tongue in quinine rashes. J. F. Schamberg (Medical News, Nov. 23, 1901).

The effects upon the hearing mainly depend upon congestion. According to Kischner and Grunert (Archiv f. Ohrenh., Nov. 30, '98), if the internal ear is unduly congested by an overdose of quinine, it may never recover its function.

Upon the respiration quinine in very large doses has a depressing action, but in medium doses its effects are *nil* or slightly stimulating.

Quinine is mainly eliminated through the kidneys when administered by the stomach. When given by the rectum, the gastric mucous membrane assists in the process of elimination (Kandidoff). A large proportion of the salt taken in any form is also destroyed in the tissues

by oxidation. A small proportion begins to appear in the urine very soon after the drug is taken, but, on the whole, the process of elimination is a slow one.

The effects of quinine salts upon the malarial parasite are studied under **MALARIAL FEVERS** in volume iv.

Poisoning by Quinine.—Poisoning by quinine is practically unknown. The untoward, or disagreeable, effects of quinine are noted under the heading treating of its physiological action, and noted briefly under **CINCHONA** in volume ii.

Therapeutics.

Malaria.—The most important therapeutic application of quinine is in the various forms of malarial disease. Quinine is a specific in this class of disorders, and is used as a prophylactic as well as a curative agent.

A point of diagnosis between malarial fever and other febrile diseases of the tropics lies in the fact that the former always yields, even at a selected time, to a single dose of quinine properly administered, while the latter do not react in this way. N. E. Legrain (*La Press Méd.*, July 7, 1900).

In the treatment of intermittent fever Bartholow observes that quinine is equally effective whether administered in the interval or during the seizure; that, if time is an element of importance, no delay is necessary in order to give the quinine in the stage of apyrexia; that the attack should be anticipated, and, if possible, prevented; that, as the maximum effect of quinine is attained in about five hours after ingestion, it should be given at least that long before the paroxysm; and, finally, that, as the elimination of quinine takes place with considerable rapidity, the maximum curative effect follows the administration of the whole amount required in a single dose. Although small doses, frequently repeated, will cure intermittent fever,

better results are obtained from a full dose (10 to 15 grains) given in the sweating stage, and the same dose five hours before the expected paroxysm. In any case the patient must receive the full physiological dose of quinine. In the treatment of this, as of all malarial affections, the bowels should be kept open and the liver properly functioning by an occasional mercurial purge; in fact, it is good practice to initiate the treatment with a full dose of calomel or blue mass. (See **MALARIAL FEVERS**, volume iv.)

In malarial fever use of quinine four or six hours before the attack reduces the number of parasites quite notably one hour or three hours later. The new generation is weak and represented by a few young spherules. These are roughly granular and without amœboid movements. When quinine is given twelve to ten hours before the attack the number of parasites diminishes, but not so notably. The remedy has least effect upon the crescents. Jancso and Rosenberger (*Pester med.-chir. Presse*, No. 8, '96).

For hypodermic injections of quinine following solution, first proposed by Kelsch, recommended:—

R Hydrochlorate of quinine, 45 grains.
Antipyrine, 30 grains.
Distilled water, 1½ drachms.

A test-tube having first been rendered perfectly clean, boiling water is placed in it, and the ingredients added; these immediately dissolve, and the solution boiling hot is filtered through a sterile piece of muslin or a sterile paper. As soon as the liquid cools sufficiently, an hypodermic syringe is filled, and, the skin having been carefully disinfected, an injection is given.

In cases of remittent malarial fever in which the stomach is in such a condition that quinine cannot be given, and the fever must be overcome, this treatment is useful, and also is of value in cases where malarial poisoning is so grave that active antimalarial influence must be brought to bear at once. Dose of the solution is 15 minims for adults

and from 5 to 10 minims for children. Should the malarial fever take an algid form, 30 minims of ether are injected simultaneously. Blum (*Jour. des Prat.*, Mar. 21, '96).

In bilious, or remittent, fever, quinine, preceded by a cholagogic purge, may be given in doses of 2 to 4 grains hourly, or in one or two large doses one-half to one hour before the expected paroxysm. If the paroxysm be near at hand, the quinine is best given dissolved by means of aromatic sulphuric acid (drop for grain).

Proper treatment of bilious fever of Africa consists in administration of large doses of quinine. Small doses aggravate the trouble, but large doses are specific. Quinine is also a reliable prophylactic. Steudel (*Med. Rec.*, June 21, '96).

Severe cases of malaria seen in India treated by giving moderate doses of quinine immediately after the paroxysm. No case ever noted which would not respond to this method of administration of quinine. The drug should be continued for some days after the paroxysm. M. C. N. Row (*N. Y. Med. Jour.*, Jan. 15, '98).

When quinine is given as a prophylactic, the use of 2 to 4 grains or more, three times daily, is advised.

In malarial cachexia, or hæmorrhagic malarial fever, quinine generally does harm. The danger in using quinine is from irritating the engorged kidneys after the chill has passed by; to do good, therefore, it must be given long enough before the paroxysm to prevent it. Quinine is not an hæmostatic, and is useful only through its power to prevent the paroxysm which causes the hæmaturia. In hæmaturia from chronic malarial poisoning without the occurrence of a chill or occurring instead of a chill, quinine is of no value. Some observers have noted hæmaturia after the use of quinine, and ascribe to the latter a causative action.

It is believed that quinine hæmoglobinuria occurs only in those whose organs have been altered by malaria, quinine alone being insufficient to produce it. Murri (*Arch. Ital. de Biol.*, tome xxviii, fasc. 3, '97).

Hæmorrhages are apt to follow the administration of quinine in malaria when the action of the kidneys is partially or completely suppressed. J. H. Sears (*Charlotte Med. Jour.*, Nov., '97).

In normal animals quinine causes congestion of the kidneys, and, as malaria causes similar disturbances, it is possible that the drug may at times act injuriously. In hæmoglobinuria, occurring with the paroxysm, quinine is probably useful for the purpose of stopping future attacks. In severe forms of malaria, with jaundice and hæmorrhagic tendency, quinine is sometimes necessary to combat the disease, but it is desirable, even in this case, to see that other drugs are used first. Hare (*Med. Rec.*, Jan. 7, '99).

In pernicious malarial fever there is usually no time to wait, and 30 to 75 grains of quinine should be given by the mouth, by the rectum, and subcutaneously, in divided doses within twelve hours. In addition to the administration of quinine, symptomatic treatment is usually necessary on account of the condition of the gastro-intestinal tract, the kidneys, the lungs, and the nervous system, any or all of which may require attention.

In chronic malarial intoxication evinced by diarrhœa, dysentery, jaundice, or chorea, occurring in the periodical form, quinine does good alone, or better when combined with iron or arsenic. In brow-ague, or malarial neuralgia, quinine often relieves in doses of $1\frac{1}{2}$ to 3 grains given every hour or two.

Quinine is a specific for the simple intermittent or remittent forms of malaria only, and has no specific action in the chronic forms of the disease which are associated with no fever or with a continuous fever. J. G. Van Marter, Jr. (*Va. Med. Semimonthly*, Jan. 28, '98).

ANTIPYRETIC ACTION.—The antipyretic action of quinine is obtained from doses of from 15 to 30 grains given in the course of an hour. For the reduction of the temperature in typhus and typhoid fever, quinine, even in very large doses, is inferior to the newer antipyretics, which latter have, in turn, been superseded by the use of cold baths. In these fevers quinine will seldom cause a considerable fall of temperature before crisis or lysis, but will aid in the fall actively after these changes; in other fevers any good results obtained through the use of quinine are due either to specific antimalarial influence or to its stimulating influence upon the general system. (Hare.)

Quinine has been used in yellow fever, and in the hectic fever of phthisis in doses of 2 or 3 grains given every two hours.

Urethral fever from catheterization may be prevented by quinine, given in full dose before the introduction of the catheter.

In acute and subacute rheumatism, lumbago, and muscular pain from cold, quinine salicylate may be given in doses of from 10 to 30 grains during the attack, and in smaller tonic doses (1 to 2 grains) three or four times daily, after the painful symptoms have subsided; in this latter condition the following is useful: Sulphate of quinine, 1 drachm; tincture of the chloride of iron, 1 ounce; elixir of cascara sagrada, 4 ounces; of this take a dessertspoonful three or four times daily.

INFLAMMATION AND SUPPURATION.—In acute catarrhal inflammation of the air-passages 10 grains of quinine combined with Dover's powder, opium, or morphine, if given early, will avert the attack. Ten grains of quinine given at the beginning of an attack of acute ton-

sillitis will sometimes abort the disease and prevent the formation of pus.

In influenza 8 grains of quinine taken every day or two acts efficiently as a prophylactic.

In the broncho-pneumonia of measles large doses of quinine relieve the catarrhal pneumonia and retard or prevent cheesy degeneration of the lung.

In the lobar pneumonia of children 2 grains of quinine given three times daily will favorably influence the disease. In the pneumonia of adults quinine checks the escape of the white blood-corpuscles and prevents the exchange of oxygen by the red blood-corpuscles. In croupous pneumonia, pleurisy, and endocarditis 20 to 40 grains of quinine, administered during the congestive stage and before exudation has occurred, is said to abort the disease.

In septicæmia, pyæmia, and puerperal fever good results are obtained through the use of from 5 to 20 grains of quinine every four hours. When abscesses are present quinine reduces the discharge and prevents sapræmia or pyæmia. In erysipelas quinine may be given alone in doses of from 5 to 20 grains every four hours or in smaller doses (2 to 5 grains) combined with the tincture of the chloride of iron (10 to 20 minims).

TONIC.—As a tonic, quinine is not only a simple bitter, but it also seems to have a direct effect in increasing the number of the red blood-corpuscles. The tonic dose of quinine is from $\frac{1}{2}$ to 2 grains. In all atonic disorders—such as neuralgia, dyspepsia, night-sweats of phthisis, general debility, neurasthenia, etc.—quinine is a reliable remedy. In simple debility or that following convalescence from an acute disease, quinine in 1- or 2-grain doses given three times daily will prove beneficial. Quinine is useful when prolonged mental or physical strain

is to be undergone; 2 to 4 grains daily will often prevent exhaustion and support the system.

In hemicrania due to malarial intoxication, and associated with a nervous condition or hysteria, the valerianate of quinine in doses of from 1 to 6 grains, repeated every two to six hours, will afford relief.

Catarrh of the stomach, due to alcoholic excess or not, will be benefited by small doses of quinine hydrochlorate, temporarily employed; its value is enhanced by combining it with a mineral acid; its beneficial action ceases when irritation of the gastric mucous membrane is produced through its use.

In subacute gastro-enteritis (cholera infantum) quinine will often effect a cure after astringents and laxatives have failed. Quinine is also good in the following condition: Tenesmus, and after much straining the patient voids a transparent mucus streaked with blood, with no fever or other disturbance of the bowels, and stools, when passed, are natural (Bartholow).

In delirium tremens tonic doses of quinine do good. In bronchorrhœa quinine in tonic doses will lessen the discharge. In cases of prolonged suppuration quinine in tonic doses is of value as a support to the system.

In the eruptive fevers, variola, scarlatina, measles, etc., quinine in small doses, frequently repeated, are valuable in adynamic states, and in larger doses at longer intervals to control hyperpyrexia.

CUTANEOUS DISORDERS. — In many skin diseases—acne, impetigo, erythema nodosum, and ecthyma—small daily doses of quinine are beneficial. Quinine is often an ingredient of hair-tonics on account of its antiseptic and tonic action. Brinton suggests the following in alopecia: Sulphate of quinine, 80 grains;

alcohol, 4 ounces; tincture of capsicum, tincture of cantharides, and aromatic spirit of ammonia, of each, $\frac{1}{2}$ ounce; glycerin, 4 ounces; water, a sufficient quantity to make 1 pint; to be used locally, being well rubbed in.

ANTISEPTIC. — Quinine has decided antiseptic properties. It is often used for intestinal antiseptis. In amoebic dysentery quinine by rectal injection will effect a cure; a solution of the strength of 1 to 3000 will destroy the amoeba coli.

In cholera the use of quinine was suggested by E. B. Fullerton (N. Y. Med. Jour., Aug. 18, '94), 15 to 20 grains being given within two hours at the beginning of the attack; he also advised its use as a prophylactic.

In typhus fever the salicylate of quinine is recommended as an intestinal antiseptic. In aphthous ulceration consequent to enterocolitis and in the yeasty vomiting produced by the growth of *Sarcina ventriculi* quinine is valuable. In subacute or chronic cystitis the irrigation of the bladder with a 2-per-cent. solution of quinine will prevent decomposition of the urine. In hay fever, after the subsidence of the acute symptoms, nasal irrigations, with an aqueous solution (0.2 per cent.) of the bisulphate of quinine, have been followed by great relief. Quinine has been used externally as an antiseptic dressing to wounds, ulcers, etc.

In infected wounds which show no disposition to heal, treatment with a 1-per-cent. solution of sulphate of quinine cleanses them rapidly and tends toward recovery with greater rapidity than with a dressing of sublimate or iodoform. Wounds not infected also recover with astonishing rapidity under its influence. Alfödi (Ther. Monats., Feb., '93).

ANTISPASMODIC. — Quinine has been found useful in various disturbances of the motor system. The hydrobromate of quinine has given relief in many cases of laryngismus stridulus.

In asthma, after the severity of the paroxysm has somewhat abated, quinine has been useful in the succeeding fever and later as a restorative tonic.

In some cases of pertussis great benefit has been derived from the use of quinine, $1\frac{1}{2}$ grains being used for each year of the child's age, to be given at 6 A.M., 2 P.M., and at 10 P.M., as suggested by Barow. It may also be given in large doses conjoined with the local use of a quinine solution (0.2 per cent.) in spray as advised by Henke. Hare uses quinine chocolates (1 grain of tannate in each) internally and a spray by means of an atomizer (solution 1 or 2 grains to 1 ounce), the tip of the atomizer being carried well back of the root of the tongue, and used every few hours; if the taste of the quinine is very objectionable, a solution (1 per cent.) of cocaine may be painted over the dorsum of the tongue.

This quinine-spray is also useful in coryza and in foetid sore throat.

In chorea H. C. Wood has suggested the use of large doses of quinine with the idea of stimulating the inhibitory control of muscular movements, acting upon the theory that this disease is due to lack of inhibitory control of muscular movements.

ECBOLIC AND EMMENAGOGUE. — Quinine has been used in uterine inertia in weak and debilitated women. It is, however, little used, as it lacks efficiency. Quinine of itself will not cause abortion; but, in nervous or hysterical patients having a tendency to abort, it is best to combine with it a sedative, as one of the bromides or opium, when necessity demands a full dose of quinine.

As an oxytocic, quinine sulphate usually acts within twenty to thirty minutes, and should be given in two doses of 8 grains each, repeated after an interval of ten minutes. It is indicated when uterine contractions are insufficient or

inertia exists during the dilatation of the cervix, and when the health of the mother or child is threatened, especially when the membranes have ruptured and delivery must be hastened. Schwab (*Jour. de Méd. de Paris*, Nov. 29, '96).

For quinine the following advantages as oxytocic noted: (1) its preparations are not variable; (2) it can easily be administered in the form of a pill, which will keep for any length of time without deterioration; (3) it does not cause tetanic contraction of the uterus, but merely increases the strength of the labor-pains, while allowing complete relaxation between them.

Quinine, like other oxytocics, must not be given when there is any mechanical hinderance to delivery, such as disproportion in size between the fœtus and the pelvis. Four-grain pills of the sulphate may be used, 2 of these being given to begin with, and, if necessary, another an hour later. Sometimes a fourth is used. Owen Mackness (*Edinburgh Med. Jour.*, May, '98).

In amenorrhœa quinine is given in small doses to stimulate the menstrual flow. It will also increase the lochial discharge. In anæmic patients quinine may, with advantage, be given with iron, manganese, or arsenic.

Topical application of quinine to surface of vaginal mucous membrane in cases of leucorrhœa favored. It may be used either in the form of a douche or pessary, but latter form considered the better. Hardwicke (*Lancet*, Jan. 7, '99).

Muriate of quinine employed in treatment of leucorrhœa, granular erosion of the cervix, vaginitis, and septic endometritis. The drug is a powerful antiseptic and is slightly astringent. As an intra-uterine douche it has proved to be un-irritating and free from toxic effects. Pessaries containing 2 or 3 grains of the muriate combined with extract of hamamelis largely used. For douching, a grain to the ounce of warm boric-acid solution is employed, the same strength being used in douching the bladder. R. S. Miller (*Lancet*, Jan. 21, '99).

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R

RABIES.

Synonyms.—Lyssa; hydrophobia.

Definition.—An acute infectious disease of animals occasionally communicated to man, characterized by excitement, hyperæsthesia, deglutitionary spasm, and paralytic weakness; when not specifically treated ending in death, and undoubtedly caused by a specific bacterial poison.

Incubation and Symptoms.—The period of incubation varies widely in different cases. It is shorter in children than in adults and in wounds about the face, head, and hands, or uncovered parts, than in the case of injuries received in other parts of the body through the clothing. The severity and character of the wound also influences the time of onset, the symptoms appearing sooner in cases of infection from punctured and lacerated wounds.

The usual incubationary period is four to eight weeks, but it may be, in occasional instances, six months or even a year or more. The wound through which infection takes place has usually healed entirely before any symptom of rabies is apparent, but in some cases, when the disease appears, the wound becomes irritated and again inflamed. Of persons bitten by *rabid* dogs, only a small proportion—10 to 20 per cent.—become infected.

The early symptoms in man are general nervousness, with irritability, wakefulness, and depression of spirits. There is often headache and vague uneasiness, sometimes slight fever and rapid pulse, and the wound may become painful and the surrounding tissue show perversion of sensation, with some anæsthesia. Some slight stiffness about the muscles of the throat is now noted, the voice changes or becomes husky, and swallow-

ing becomes difficult. Soon great restlessness and excitement supervene, together with general hyperæsthesia and abnormal reaction to external impressions of all kinds, to the extent, so soon as the height of the attack is reached, of causing reflex spasms. These spasms are quite distressing and severe, and involve particularly the muscles of the larynx, pharynx, and mouth, and are accompanied by a sense of intense dyspnoea. Attempts at swallowing or taking water precipitate the violent and painful spasmodic attacks, which fact causes the patient to dread even the sight of water; whence the common name of the disease: "hydrophobia."

There is often at this stage some mental disturbance, greatest at time of the deglutitionary and respiratory spasms, subsiding in the interval. In other cases delusions and hallucinations, with maniacal excitement, may continue throughout the attack. In some cases there are more general convulsive seizures, resembling, somewhat, those of tetanus. The disease may run its course without rise of temperature, but most cases show some febrile reaction, 100° to 102° being usual. There is oftentimes a copious secretion of saliva, which, owing to the difficulty in swallowing, is allowed to run from the mouth.

The acute spasmodic stage lasts for a day or two, and is then succeeded by a paralytic stage, in which the patient lies quiet, nearly helpless, confused, and finally unconscious. The heart-action becomes progressively more feeble, the respiration shallow and increased in frequency, and death ensues.

In man the initial stage of excitement is rarely absent. But in animals its absence is the usual rule, the stage of pa-

ralysis quickly supervening upon the first symptoms of the disease.

Mention should here be made of the so-called pseudorabies, or lyssophobia: *i.e.*, the morbid fear of hydrophobia, leading, by the influence of autosuggestion, to a group of nervous and hysterical manifestations closely simulating the true disease. A neurotic person of inherited nervous instability and easily influenced by suggestion is bitten by a dog supposed to be mad; after a variable time and often in direct consequence of having been joked about the danger, or from brooding over the possibility of an attack of the disease, some nervous symptoms paralleling those of rabies appear. The subject becomes apprehensive, despondent, restless, then excited, and exhibits some spasm or a choking sensation in the throat, this being often only a perversion of the frequently-seen *globus hystericus*. Occasionally convulsive attacks of an hysteroid character occur. The patient exaggerates the danger and protests that he is really going mad. Other varied hysterical phenomena may be present. The attack does not progress, however: there is no disturbance of general health nor of any of the bodily functions, no temperature-changes, no weakness, no prostration. The attack lasts for days or weeks and then subsides. Probably no case has ever proved fatal, the alleged fatal cases being instances of true rabies, as, on the other hand, many of the cases of reported recovery from rabies are most likely instances of the pseudal affection.

During the year 1897 three deaths were reported to the coroner's office of Philadelphia as having been due to rabies. A thorough study of the cases by the approved methods of the day was made, and the deaths were all found not to have been due to rabies. In order to allay, so far as possible, the deep-seated

popular dread of the disease, though not denying its existence, Coroner Ashbridge called attention to the fact that during his seventeen years' service in the coroner's office not one of the many cases of hydrophobia so reported in the papers and investigated by those connected with the office had proved to be such upon careful inquiry. H. W. Cattell (*Phila. Med. Jour.*, Jan. 14, '99).

Outbreak of rabies among the dogs of the District of Columbia. Eighteen children and six adults have been reported to the U. S. Bureau of Animal Industry as having been bitten. Thanks to the Pasteur treatment, which nearly or quite all of the bitten persons have taken, there have not yet been any deaths from hydrophobia among human beings. There has, however, been much suffering from deep and lacerated wounds, from cauterization, and from the preventive vaccinations. The writer diagnosed rabies when the first post-mortem examinations were made, but preferred to withhold his decision until all possibility of error had been removed by laboratory tests. These tests have now been completed and the results are conclusive. D. E. Salmon (U. S. Department of Agriculture, Bureau of Animal Industry, 1900).

Diagnosis.—There should be no difficulty in distinguishing between rabies and other affections of the nervous system in which spasms and cramp occur. In tetanus there is the typical trismus and an absence of any dread of water. The character of the wound in tetanus is also different and the incubationary period much shorter.

The greatest difficulty lies in distinguishing a true rabies from the pseudorabies above described. Here a careful consideration of all symptoms and a complete and searching test of the nerve-reactions may be needed to prevent error. The evident influence of suggestion, the discovery of hysterical tendencies and stigmata, the absence of any real prostration and of any progress

in morbid process shall exclude the pseudohydrophobic cases.

In the clinical symptoms of hydrophobia the more the intellectual centres are disturbed, the greater the difficulty of diagnosis. In most cases in man, however, the intellect is untouched until the last moments. In timid persons there may be fear of death as they perceive the gravity of their disease. The great symptom is not "hydrophobia," but a disarrangement of inhibitory control of automatic reflexes of the throat and chest and muscular system, hyperæsthesia of the senses and skin, and a tendency thereby to convulsions. Sometimes the intellect is badly affected. J. Hartley Anderson (Phila. Med. Jour., June 3, '99).

The diagnosis of rabies may be established by noting the alterations found in the central nervous system. The peculiar changes described by Van Gehuchten and Nelis may be of value. A normal nervous system cannot be present in a hydrophobic animal. G. Daddi (Rivista Critica di Clinica Medica, Apr. 7, 1900).

Investigations to ascertain whether the lesions of the plexiform ganglia of the pneumogastric were always present in rabies, as stated by Van Gehuchten and Nelis. In the first dog, rabies, after 17 days of inoculation, and killed 17 hours after the first appearance of the symptoms, the cells of the ganglia were absolutely normal. The same results were reached in a second dog, killed in the first attack after 23 days of incubation. The third dog, seized with madness after 32 days of incubation, had marked lesions of the ganglia. Half the cells were destroyed, and the whole of each ganglion was infiltrated with leucocytes. A fourth dog had very slight lesions. On the whole, the author thinks that when the results are negative the dog cannot be considered to have been free from suspicion of rabies, and the persons bitten should be taken to a Pasteur Institute. M. Nocard (N. Y. Med. Record, from Bull. de l'Acad. de Méd., Apr. 17, 1900).

Early diagnosis of rabies procurable by microscopical examination of the cord. There is a diffuse chromatolysis affecting

all the cells, followed by a retraction of the cells from the capsules and a proliferation of the cells of the capsule. These press on the degenerating ganglion-cell, destroy it, and fill up the space occupied by it. The chromatolytic changes are best seen by Nissl's stain and the capsular changes by hæmatoxylineosin. M. P. Ravenel and D. J. McCarthy (Proc. Path. Soc., July, 1900; Med. News, Aug. 25, 1900).

If, after microscopical examination of the spine and bulb, no perivascular or pericellular miliary nodule is found, it is to be regarded as highly probable that the animal bitten was not mad. Pericellular nodules speak in favor of rabies. When the medulla, spinal cord, and ganglia present no leucocytic thromboses or perivascular or pericellular undulations, it is very probable that the dog was not mad, and, if the animal died a natural death besides, rabies was certainly not present. V. Babès (La Presse Méd., Sept. 8, 1900).

Etiology.—It attacks by preference the carnivora and in particular the dog and allied species, although human beings, cattle, horses, and swine are occasionally infected. It is transmitted from one animal to another by inoculation, usually from a bite, and is comparatively rare in countries and localities in which the muzzling of dogs is made compulsory.

In the dog the first symptoms appear from a few days to weeks after infection. The animal shows a change in disposition, becoming unusually irritable and snappish, although when left alone seeming dull and somnolent. Food is often refused and the animal eats or chews sticks, dirt, leaves, straw, etc. The dog becomes weak, tremulous, and unsteady on its legs in the paralytic or more common form, but in the "furious" form of the disease there is wild excitement, the animal running aimlessly about, barking, growling, and snapping at or biting anything in its way. In either case the

creature soon becomes helpless, comatose, and dies. The toxic principle of rabies is widely diffused throughout the bodily tissues, and the disease has been produced by the experimental inoculation of portions of the nervous organs, salivary and mammary glands, suprarrenal bodies, and pancreas. The virus is almost surely the product of a specific micro-organism, although bacteriologists have thus far been unsuccessful in attempts to isolate the pathogenic germ.

The virus of the dog remains potent for a long time, having been found active in the carcass of a dog which had died of rabies forty-four days before. The period of incubation is between 20 and 60 days, the disease being rare after a longer period. J. R. Bradfords (*Lancet*, Mar. 3, 1900).

A very important piece of evidence to show the infectiousness of rabies is the fact that the disease has almost entirely disappeared in England since the law compelling dogs to be muzzled has been rigidly enforced. When the enforcement of this law is left to local authorities it is seldom properly accomplished. The history of the disease in England and Scotland is very interesting and valuable. For several years the Board of Agriculture successfully enforced the law in the affected districts and the number of cases was much diminished, but, when each district managed its own affairs and respected too much the individual rights, the number of cases enormously increased to 672 in 1895. The Board of Agriculture again took charge and the number of cases has steadily decreased, so that only 6 occurred in Scotland and England during 1899 and none in 1900. D. E. Salmon (*Medical Record*, Nov. 23, 1901).

The writer concludes as follows from a detailed study of the question as to the meaning of Negri's bodies in the causation of hydrophobia. (These bodies are special structures found by Negri in the cells of the central nervous system of animals affected with rabies.) If some nervous tissue of a rabid animal be deposited upon the cerebral cortex

of a rabbit, the virus will be found localized at this site during the entire period of incubation, and will be still found there when the more distant portions of the nervous system have already become affected. If a cornu ammonis rich in Negri's bodies be deposited upon the cerebral cortex of a rabbit, these bodies do not disappear until the fourth or fifth day after the inoculation, and do not present any modifications which would point to any biological activity. They simply take part in the general necrosis which takes place in the inoculated tissue. During the following days, when the cornu ammonis is gradually disappearing, it is no longer possible to recognize the Negri's bodies. Neither are these bodies to be found in the leptomeninges which cover the inoculated spot, nor in the cortex which underlies it. The eosinophile granules which are observed in these cases are not derivatives of Negri's bodies, as they occur also when a non-hydrophobic nervous tissue is inoculated. Negri's bodies, when observed in hanging drop preparations on warmed slides, do not exhibit any spontaneous movements. Neither do they exhibit such movements when they are allowed to remain for some days within the peritoneum of an animal, enclosed in sacs of celloidin. If pieces of a cornu ammonis rich in Negri's bodies are placed in a celloidin sac and kept in a peritoneal cavity for some time, the Negri's bodies do not show any biological changes, but undergo necrosis. Therefore, we have no reasons, as yet, to think of the Negri's corpuscles as being etiological factors in rabies. Luigi D'Amato (*Riforma Medica*, Nov. 9, 1904).

OCCURRENCE IN MAN.—Rabies is always communicated to man by inoculation from bites of animals suffering from the malady.

A bite of a rabid dog will produce hydrophobia in man, but the hydrophobic man does not reproduce it in others. Rabies may be continued from dog to dog, but not hydrophobia from man to man. William T. Walker (*Va. Med. Monthly*, Feb., '96).

It is a disease now rarely seen in America and in Germany, but it is somewhat more frequent in Russia and France. It was common in Europe some decades ago, but of recent years has been markedly less frequent. In the United States most of the cases during the last half-century have been reported from the Atlantic States. There was one outbreak of rabies in Ohio in 1810. Several instances of the disease's having been communicated to man by the bites of skunks have been reported from western States. Dulles, from 1888 to 1894, collected accounts of seventy-eight cases of hydrophobia, this number doubtless representing nearly all which occurred in this country during that period.

Pathology.—The affection is, as above indicated, a specific toxæmia of unknown bacterial origin. Some morbid anatomical changes in the nervous system are nearly always found, these being: dilatation of capillaries and small blood-vessels; marked congestion, with accumulation of lymphoid cells in the perivascular spaces; minute extravasations of blood, and some degenerative changes in the ganglion-cells. These alterations have been noted in the brain-cortex, medulla, and spinal cord; and by Gowers are alleged to be most pronounced in the medulla and the region of the nuclei of the pneumogastric, hypoglossal, and spinal accessory nerves, the leucocyte-like accumulation being here so prominent as to merit the term "miliary abscess." The pathological changes in the spinal cord are usually not well marked.

The pathological anatomy of the spinal cords of rabbits and dogs that had died of rabies studied. Macroscopically hyperæmia of the meninges and congestion and points of hæmorrhage in the substance of the cord were found in irregu-

larly-distributed areas. Microscopically these areas were seen to be extensively infiltrated with leucocytes along the perivascular spaces and around nerve-cells, while there was proliferation of the endothelium of the vessels. Atrophy and vacuolation of the nerve-cells, leaving open spaces in the gray matter, were also observed. The nerve-fibres showed varicosity and vacuolation of the axis-cylinder, with degeneration of the myelin-sheath and increase in the neuroglia. The process, as a whole, consisted in an acute inflammation of the cord, tending to the destruction of the nervous elements and resulting in an hyperplasia of the neuroglia to replace them. Germano and Capobianco (*Ann. de l'Inst. Pasteur*, Aug., '95).

In rabies, the brain, the cord, and meninges are usually congested and ecchymosed; the cord also shows small softened patches, particularly in the neighborhood of the nerves by which the virus has gained access to the central nervous system. The characteristic histological appearances fall into two groups. The first comprises the more diffuse changes in the direction of general œdema and hyperæmia, which indicate the commencement of inflammatory changes around the blood-vessels. The lesions in the second group are more definite and localized. The blood-vessels are, as a rule, dilated, and more or less extensive hæmorrhages can be seen in the neighborhood of the central canal, in the floor of the fourth ventricle, and scattered through the membranes; where these are not macroscopical, the microscope often reveals extravasated red corpuscles beside the dilated capillaries. Later on little hyaline globular masses appear in the small vessels, in the walls of which broad zones of wandering cells are noted. The walls are often hyaline and much swelled; the endothelium also proliferates, so that many vessels are obliterated and surrounded by thick hyaline masses. The changes are most marked in the situations indicated by the symptoms; that is, in the motor nuclei of the cord and medulla, in the neighborhood of the ol-

factory nerves, etc. The nerve-cells, particularly in the vagus and hypoglossal nuclei, are the next to suffer. They swell, and small hyaline bodies, surrounded by a pale zone or by large vacuoles, appear in the vicinity of the nucleus. The pericellular space is filled with leucocytes, which press on the nerve-cells; later on the latter become pale and their nuclei disappear. These changes are considered to be absolutely pathognomonic of rabies. A small piece of the cord of the suspected animal should be hardened in alcohol, stained next day with aniline red, and the characteristic hyaline spots sought for. In this way a speedy and certain diagnosis has been made in over a hundred cases. Similar changes are found in the affected nerves; the salivary glands are also hyperæmic, and the acini surrounded by sound cells, in which the characteristic tiny hyaline bodies are present just as in the nerve-cells. The lungs and abdominal viscera are hyperæmic. Babès (*Wiener med. Blätt.*, Oct. 17, '95).

Amyloid bodies constantly found in the central nervous system, disposed in an irregular manner. They are composed of homogeneous substances in which a large number of granulations, characterized by their intense color, may be seen. They consist partly of distinct bacilli that frequently show at one extremity a longitudinal club-shaped swelling resembling the erosion of actinomyces. The constant presence of these parasitic bodies suggests that they may represent the pathogenic agent of rabies. Puscariu (*Sem. Méd.*, Mar. 22, '99).

The microscopical examination of a fatal case of rabies led to the following conclusions: In the dorsal and lumbar regions of the spinal cord there was intense hyperæmia of the vessels in the white substance, and especially in the gray matter, with an infiltration of the perivascular spaces by lymphoid elements. In sections prepared after the method of Bousch there were several small black agglomerations at the periphery of the white substance, as well as a pigmentary degeneration of the cells of the anterior cornua and of Clarke's columns. In preparations

stained with basic aniline dyes numerous cells of the anterior cornua and of Clarke's columns seemed deformed and altered, presenting a chromatolysis diffuse or in spots, and marginal or perinuclear. The nucleus was displaced toward the periphery, deprived of its membrane, and it sometimes stained more intensely than the cell-body itself. In certain cells the processes were broken. All these changes were more marked in the cervical enlargement and in the bulb. In the depths of the floor of the fourth ventricle there were small hæmorrhages. S. Tchernischeff (*Archives de Neurol.*, Apr., '99).

The pathologico-anatomical changes of asphyxia are often present, predominating in some cases or even being the only lesions found. The mucous membrane of fauces, pharynx, and larynx is often congested. The salivary glands have been found to show the changes of a mild inflammation, and a mild parenchymatous nephritis is often present. In dogs the stomach may contain straws, sticks, and other foreign matter eaten by the animal.

Prognosis.—The hope of recovery from true well-marked rabies is very slight, death ensuing after a few days in almost every instance. During the past ten years excellent results in preventing the development of rabies in persons bitten by rabid animals have been obtained by the use of the preventive inoculations spoken of below.

Treatment.—Immediately upon being bitten by a supposedly rabid animal a ligature should be placed upon the limb above the wound, the wound should be disinfected or, better still, thoroughly cauterized by heat or by nitrate of silver, or carbolic acid, or in some cases may preferably be excised. The wound should not be closed, but kept freely open and allowed to bleed as much as it will.

In dog-bites immediate treatment with strong fuming nitric or hydrochloric acid is recommended. One or 2 drops will suffice, and the slough soon separates, leaving a clean wound, which heals readily. J. C. Vaughan (*Indian Med. Gaz.*, No. 8, p. 273, '96).

In treating a patient bitten by an animal, the history of the animal should be obtained as far as possible. If the locality where the patient was bitten has been the seat of other cases recently, and the wound was in an exposed part of the body, hand or head, it should be cauterized thoroughly within twenty-four hours, an anæsthetic and nitric acid being used. Fuming nitric acid is more efficient than the actual cautery or pure nitrate of silver. If the wounds were severe, Pasteur preventive treatment should be given. If the bite was superficial or through the clothes, and the cauterization was made thoroughly within the twenty-four hours no more need be done, certainly not if there had been no cases of rabies in the neighborhood. The Pasteur preventive treatment can never do harm and, if the patient desires it, should be advised.

The disposition of animals which have bitten people should be as follows: Never killed, but captured, and placed in a kennel under lock and key for a week. If at the end of that time they are well, there is naturally no danger for the person bitten. If the animal dies, an autopsy should be made, all the organs examined, and a portion of the brain and spinal cord emulsified and inoculated in guinea-pigs and rabbits. If a disease which could cause death should be found in other organs, it is of importance; the inoculation tests should be made to demonstrate beyond a doubt that rabies was not also present in the same case. Follen Cabot (*Med. News*, Mar. 18, '99).

A patient in the Williamsport, Pa., Hospital, suffering from rabies, is reported to have been cured by intravenous injections of formalin solution. His arm had been mangled by a mad dog, and was amputated, but rabies developed later. A rapid fall of tem-

perature and improvement in all the symptoms is said to have followed the administration of the remedy. (*Medical Record*, Mar. 14, 1903.)

At the time of onset of the first symptoms of hydrophobia these local measures may properly again be resorted to should any evidences of irritation of the wound be present. The patient should be kept in a darkened room and free from any sources of irritation or annoyance. Restraint of any kind is not necessary, there being, contrary to common belief, little or no tendency on the part of the patient to injure others, and there is no danger of those in attendance contracting the disease. The patient should not be forced to make attempts at swallowing food or drink. Nutrient enemata should be employed, and large quantities of water be given by the rectum.

Local applications of cocaine to the fauces and pharynx are said to prevent spasm and enable the patient to swallow.

During the violent spasms chloroform may be used by inhalation, and the administration of bromides and chloral by the mouth and of morphine hypodermically are followed by some amelioration of the acute symptom. Curare, in $\frac{1}{10}$ - to $\frac{1}{4}$ -grain doses every half-hour until muscular relaxation occurs, is lauded by some. All such remedies are, however, merely palliative and exert no influence over the course of the disease.

Preventive Inoculation.—The work of Pasteur in developing the treatment of rabies by preventive inoculation constitutes by far the most important addition to our knowledge of the nature of the affection and the possibilities of its cure which has been made since the disease was first recognized. Pasteur found that the toxin in the spinal cords of rabbits which had been killed by

rabies inoculation gradually lost its virulence if the cords were kept for some days under antiseptic precautions; so that after about two weeks the cord was no longer poisonous, inoculations from it failing to produce the disease. This fact offered then a method of gradually establishing an immunity, by inoculating the infected animal with cords which had, to a certain degree, lost their virulence through preservation in this way.

The production of artificial immunity is the now widely and successfully employed Pasteur treatment for rabies, persons bitten by mad dogs being carried through a series of inoculations with the spinal cords of rabbits. The inoculation is begun with cord which has been kept for 14 days; the second day cord 13 days old is employed; the third day 12-day-old cord, and so on until cord 5-day-old is reached, when a new series of inoculations is commenced with the cord of the ninth or tenth day. In the "intensive" method the inoculation of the morning of the first day is from cords 14 and 13 days old rubbed up together, cords of the 12th and 11th days being used the same evening, cords of the 10th and 9th days the following morning, and cords of the 8th and 7th the same afternoon. On the third day cord 6 days old is used; on the fourth day cord 5 days old, on the fifth day cord 4 days old, on the sixth day cord 3 days old; then a new series is begun with cord 5 days old. After from one to several weeks of this treatment the patient is regarded as immune, and the subsequent development of rabies is but slightly to be dreaded.

Instead of using Pasteur's method of protective "vaccination" for the animals from which the serum is to be obtained, according to personal method, the virus that is to be used is attenuated by a process of peptic digestion. The activity

of the virus is thus so far modified that considerable doses may be injected at a comparatively early stage of the process; the animals that have been so injected withstand the action of the more virulent virus within a comparatively short period. When an inoculation with a lethal dose of the poison is made, a comparatively small quantity of the serum serves to neutralize its effect if injected at once, and even if delayed until the end of the first half of the incubation-period the amount required to be given has only to be multiplied some six or eight times. It is possible, by drying, to prepare a "permanent" form of this serum which will, if kept from air and light, remain active for a long period. It is very portable, is readily dissolved, and may be used by anyone who is capable of sterilizing a subcutaneous injecting needle and syringe. The treatment, therefore, can be commenced almost as soon as the patient has received the bite, as it is not necessary that he should leave his home or his own medical attendant, with the result that the patient at once receives a quantity of the anti-toxic material, which under the Pasteur method could only be manufactured in the body of the patient himself, and then in quantities sufficient to neutralize the infective material, say, after the second half of the incubation-period. Tizzoni and Centanni (*Atti della Reale Accad. delle Sci. dell' Inst. di Bologna*, Feb. 10, '95).

The treatment of rabies, save Pasteur's, is unsatisfactory, and that is futile unless taken in time. Denny (*Northwestern Lancet*, Apr. 1, '96).

In the treatment of hydrophobia it is far better to expel the poison and withdraw the excess of blood from the congested cerebral area, than to attempt to immunize the party bitten by the further absorption of the same poison which induces the disease. The treatment personally advocated is the "Buisson" bath, which is a vapor-bath (commonly called Russian). The theory, according to Buisson, is simply that sweating (increased by hot drink) opens all the pores of the skin, and all poisonous matter in the blood or in surface wounds is forced

out through the pores. When the Buisson bath is used and profound sweating results, not only is the poison, if there is one, eliminated, but also the excess of blood, demonstrated to be in the central nervous system by the evidence of symptoms and also pathological testimony, is speedily withdrawn from the congested cerebrum and centres, and as a result the symptoms are subdued and the patient recovers. Beverly O. Kinnear (*Med. Record*, July 22, '99).

In the care of patients suffering from rabies it is especially necessary to take great precaution with regard to the saliva. While there are no cases on record of infection by this means, there is no doubt that the saliva carries the infectious agent of the disease. Too much care cannot be taken, therefore, with regard to basins, towels, the hands of the patients, the sheets, pillow-cases, and other things that come in contact with the saliva. In every case of dog-bite that comes for treatment the patient should be asked whether the bite was inflicted by a stray or by a known animal. If by a stray animal, then the case should be suspected and for safety's sake the Pasteur treatment should be advised. Wilson (*Med. News*, Aug. 11, 1900).

Of 14,000 persons inoculated in eight years only 70 died of the disease, these fatal cases being chiefly persons who came for treatment months after the bite was received. There can be no doubt that the mortality from rabies has been enormously lessened by the use of this method of treatment.

For the year 1889, in the Department of the Seine, 6 deaths occurred from hydrophobia: 3 in persons who had undergone treatment in the Pasteur Institute and the other 3 in those who had received no treatment whatever. Pasteur's inoculations do not prevent the disease. The rigid enforcement of the law in reference to stray dogs is of more importance. Dujardin-Beaumetz (*Jour. de Méd. de Paris*, '90).

The statistics of the Imperial Institute of Experimental Medicine at St. Petersburg for 1893: 486 persons applied for

treatment,—the largest number thus far. Of these, 101 were judged, for various reasons, not to require treatment. In addition to these 16 had no wound, 6 were bitten by animals which were found later on to be free from rabies, and 5 refused to continue the treatment. This makes the total number of patients 358, of which number 4 died, 1 during the treatment. Excluding this case, the mortality was 0.84 per cent. Kraïouschkine (*Archives des Sci. Biol.*, vol. iii, No. 2, '95).

From the annual report of the Odessa Antirabic Institute, it appears that, during 1894, 984 persons were treated, 42 of whom had not been bitten, but had been in danger of infection, either while treating men or animals suffering from the disease or in making autopsies of animals succumbing to it. The mortality was 0.21 per cent. Diatropow (*Archives des Sci. Biol.*, vol. iv, No. 1, '95).

The following are statistics of the Pasteur Institute of Paris for 1894: 1392 cases treated, 12 deaths. In 5 of the mortal cases the first symptoms of rabies were evident less than fifteen days after the last inoculation. Not counting these, there remain 1387 cases with 7 deaths, or 0.50 per cent.; 3 cases, in addition, were attacked by rabies in the course of the inoculations. Out of the 1387 cases 226 were foreigners. Pottevin (*Annales de l'Inst. Pasteur*, July, '95).

Evidence adduced which shows, from the statistics of every country where Pasteur institutes have been established, that the mortality from hydrophobia has actually increased. The enactment of a dog-muzzling law urged as the most important measure for limiting the ravages of this disorder. C. W. Dulles (*Med. Record*, July 13, 1901).

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RECTUM AND ANUS, DISEASES OF. (See also HÆMORRHOIDS, volume iii.)

Irritable Ulcer of the Rectum, or Fissure of the Anus.

Definition.—Primarily, a superficial breach of the mucous membrane in the

anal region, which, if unhealed, finally results in the formation of an ulcer of the bowel. This may involve both the mucous and submucous coats, and give rise to a spasmodic contraction of the parts and paroxysmal pain.

Symptoms.—In the early stages the symptoms are not usually marked or even severe. They are generally experienced during defecation, when at some point or other there will be an uneasy sensation, consisting of an itching, pricking, slight smarting, or a feeling of heat about the circumference of the anus. As the disease progresses the discomfort attending the movements of the bowel is greatly augmented; there may be severe pain, of a burning or lancinating character. This is followed by throbbing and excruciating aching, attended by violent spasmodic contraction of the sphincter-muscles, continuing from half an hour to half the day. While the pain lasts the patient is usually incapacitated for work. The slightest movement sometimes greatly aggravates the suffering.

After an indefinite period the pain subsides or entirely disappears, the patient feeling fairly comfortable or even perfectly well, and to all outward appearance he would continue so were it not for the knowledge that the subsequent passage of faecal matter will bring with it a recurrence of agony. In consequence of this dread, the act of defecation is postponed as long as possible, with the result that when the evacuation does take place the pain is greatly increased. The faeces, when solid, will be passed streaked with mucus and sometimes also with blood, and when more soft will be flattened and tape-like, due to the incomplete relaxation of the sphincters. Not infrequently the appearance of such a stool leads to an erroneous diagnosis of stricture of the rectum.

When a fissure is of long duration, the general health becomes greatly impaired as a result of the constant pain, the constipation, and the frequent resort to narcotics, and the patient is liable to fall into a state of melancholy and extreme irritability. The countenance, expressive of pain, grows care-worn and sallow; the appetite is poor; and there is more or less emaciation, associated with the general appearance of a person suffering from serious organic disease. Flatulence generally attends severe cases; it is not only troublesome, but painful, the passage of gas being almost certain to bring on a paroxysm of pain.

The ulcer is usually located just within the anus, beginning at the mucocutaneous junction, Hilton's line, and extending upward toward the rectum for a distance seldom exceeding half an inch. It may occupy any portion of the circumference of the anal region, but its usual site is at its posterior, or coccygeal, side. Although this lesion is usually solitary, we sometimes find it multiple, especially when of syphilitic origin.

Diagnosis.—The signs are so characteristic of the lesion that it is almost impossible for a diagnostic error to be made. The peculiar nature of the pain, the time of its occurrence (either during or some time after an evacuation of the bowels), its continued increase until it becomes almost unbearable, and its gradual decline and entire subsidence until the next evacuation clearly point to irritable ulcer of the anus, and in most instances should be sufficient to establish a diagnosis. Yet in numerous well-authenticated cases mistakes have been made and patients suffering from this disease have been treated for neuralgia, uterine or vesical affections, stricture, and even hæmorrhoids.

This disease is very readily distin-

guished from neuralgia by the absence in the latter of any breach of surface or of any other disease of the mucous membrane of the rectum; by the entire want of connection between the pain and the alvine discharge, and by the constant suffering. In neuralgia the pain caused by pressure with the finger in the anus is not confined to one spot, as it is in fissure, but all parts of the bowel are alike tender.

The symptoms of anal fissure often simulate closely those of uterine disease and bladder affections. Spasm of the sphincters in these cases may also simulate stricture, but a thorough examination will dispel all uncertainty.

Frequently, uterine disorders or hæmorrhoids are associated with the fissure; in this event the case is treated for either one or the other of the first two complaints, the presence of the other lesion being unsuspected and consequently neglected. In all such instances a careful inspection of all the parts will at once prevent all errors. Small polypoid growths are often found at the upper portion of the fissure and unless removed will prevent successful treatment.

[Fissure of the rectum is one of the causes of dyspareunia, which may be diagnosed as vaginismus. The cure of the fissure will be quickly followed by relief of the symptoms. C. B. KELSEY, Assoc. Ed., Annual, '92.]

Etiology and Pathology.—Fissure is a disease of adult life, and is said to be more common among women than among men. Very young children, however, are not exempt, and my experience would lead me to suspect that it often exists in many such cases without being discovered. The intense suffering is due to the structural arrangement of the termination of the bowel, especially its nerve-supply. As is well known, the outlet of the intestine is closed by two

sphincter-muscles, the external being immediately beneath and parallel to the skin surrounding the margin of the anus. On the inner side, or rectal surface, the muscles are in contact, the line of union corresponding accurately with the junction of the skin and the mucous membrane. In most cases this junction of the sphincters is marked by a line of condensed connective tissue, and is known as "Hilton's white line." Attention is drawn to this term because of an important anatomical fact, which Hilton has pointed out in this connection: to wit, that it is the point of exit of the nerves, principally branches of the pudic, which descend between the two sphincter-muscles, becoming superficial in this situation, and are there distributed to the papillæ and mucous membrane of the anus. These nerves are very numerous, and account for the extreme sensitiveness of the part and also for its very abundant reflex communications with other organs (Andrews, "Rectal and Anal Surgery," second edition, Chicago, p. 69). The exposure of one of their filaments, either in the floor or at the edge of the ulcer, is an essential condition of the existence of irritable ulcer. The upper portion of the rectum possesses very little sensibility, as the chief nerve-supply of the organ is at its termination and around the anus; hence it is that such grave diseases as cancer or ulceration may exist in the higher parts of the bowel and not manifest their presence by pain.

Irritable ulcer may arise from a variety of causes, such as atony of the muscular coat of the rectum, or other conditions leading to constipation. In these cases the bowel becomes impacted with hardened fæces, which when discharged overstretch the delicate mucous membrane, and thus, either by irritation or by direct abrasion, the ulcer is formed.

William Bodenhamer ("Anal Fissure," '68, New York) states that, in some cases of constipation, while the diaphragm and other abdominal muscles act with considerable energy, the anal sphincters remain more or less contracted, and yield but slowly, so that the indurated fæces contuse and abrade the surface of one or more points of the mucous membrane, which abrasions, if they do not heal, lay the foundation of the disease.

Irritable ulcers sometimes result from the excoriations produced by vitiated and acrid discharges, such as occur in dysentery, chronic diarrhœa, cholera, leucorrhœa, etc. Hæmorrhoids are frequently a predisposing cause and a complication. They narrow the outlet of the bowel, and through the successive inflammatory attacks to which they are subject the neighboring tissue loses its elasticity, is rendered brittle, and is much more easily lacerated.

Polypi are not uncommon causes; they are usually situated at the upper or internal end of the ulcer.

Prognosis.—With proper treatment irritable ulcer can be promptly cured and practically without risk.

Treatment.—The first step is to establish regularity in the intestinal functions. Enemas or mild aperients should be employed and the diet regulated, the use of bland and unirritating food being enjoined. All drastic purges should be avoided. To obtain a daily evacuation of the bowels and to render the movement as painless as possible, a 10-grain suppository of iodoform is to be used, followed, in one-half hour, by an enema of rich flaxseed-tea, from half a pint to a pint. This should be administered every evening before retiring, the patient being then able to assume the recumbent posture, which, combined with

the rest, affords the most relief from subsequent pain. Immediately after an evacuation of the bowels is obtained, another 10-grain iodoform suppository is to be inserted into the rectum. The suppository relieves the pain, and is far preferable to opiates, which tend to constipate. If the enema should prove ineffectual, another should be employed in half an hour.

PALLIATIVE MEASURES.—Palliative treatment will meet with success in a considerable proportion of cases, especially when there is no great hypertrophy of the sphincter-muscles. The Allinghams state that the curability of this lesion does not depend upon the length of time during which it has existed, but rather upon the pathological changes it has wrought. They have cured fissures of months' standing by means of local applications, where the ulcers were uncomplicated with polypi or hæmorrhoids, and where there was not very marked spasm or thickening of the sphincters.

Rigid cleanliness is essential. The anus and the adjacent portions should be carefully sponged night and morning and after each stool with hot or cold water, the temperature being regulated to suit the patient's comfort.

Before applying remedies the ulcer should be exposed and anæsthetized with a 4-per-cent. solution of the hydrochlorate of cocaine, using a camel's-hair pencil, and repeated once or twice, at intervals of three or four minutes.

Among the remedies used the following may be mentioned: Nitrate of silver; acid nitrate of mercury; fuming nitric acid; carbolic acid; sulphate of copper; the actual cautery. Of these, the nitrate of silver is the best. It lessens or obviates the nervous irritation underlying spasmodic contractions of the sphinc-

ters; it shields the raw and exposed mucous surface, by forming an insoluble albuminate of silver; and destroys the hard and callous edges of the ulcer.

To attain the best results, a solution of 10 to 30 grains to the ounce of distilled water should be used once in two or three days, according to circumstances. It may be applied by means of cotton attached to a silver applicator or to a piece of wood, separating the margins of the anal orifice with the thumb and index finger of the left hand. The solution is to be applied to the ulcer only; a few drops are all that will be required. If thorough local anæsthesia has been obtained the drug produces little, if any, suffering. After each application the part should be dusted with iodoform.

Fissure of the anus without operation:

The patient remains in bed on fluid diet for one week, taking 10 drops of tincture of opium three times a day. Absolute constipation being thus obtained, the fissure is sprinkled with iodoform or calomel, but without the use of any antiseptic liquids. After eight days a large dose of castor-oil is given. Often the first defecation is quite painless, and the fissure is cured. Rarely has this treatment to be repeated. I. Boas (*Revue d'Obstét. et de Gyn.*, Jan., 1900).

Fissure in ano is a pathological condition of the anal innervation comparable to nervous dysphonia, cough, etc. Massage to relax the spastic condition should be resorted to and the patients be taught to introduce the finger into the rectum and practice rotary and other movements. Later on the rectal tube may be used, the bowels being carefully regulated. Improvement usually follows within four or five days, and cure is frequent. O. Rosenbach (*Berliner klin. Woch.*, Mar. 12, 1900).

When this plan of treatment fails, resort to operative measures is indicated.

Ichthyol is of great value in the treatment of fissure of the anus. At the first application the fissure is anæsthetized with cocaine and pure ichthyol is ap-

plied with a cotton-carrier or a glass rod. For the succeeding applications, which at first are made daily, then on alternate days, cocaine is generally unnecessary. A cure is usually achieved in from six to twelve days. Proper attention must be given to the bowels. Conitzer (*Münch. med. Woch.*, Jan. 17, '99).

OPERATIVE TREATMENT.—There are three methods worthy of consideration in this connection: (1) *forcible dilatation*; (2) *incision*; (3) *a combination of these two procedures*, to wit: *forcible dilatation and incision*.

Forcible Dilatation.—This is the operation recommended by Récamier, Van Buren, and others. It consists in introducing the two thumbs into the bowel back to back, and then forcibly separating them until the sides of the bowel are stretched as far out as the tuberosities of the ischia. It is essential to place the ball of one thumb over the fissure, and that of the other directly opposite to it, in order to prevent the fissure from being torn through and the mucous membrane being stripped off. This procedure should always be done with the patient thoroughly under the influence of an anæsthetic, and it should occupy about five minutes.

The operation is a perfectly safe one, but as it is no less severe than the operation by incision and as in some cases it fails to effect a cure, there is no advantage in adopting it instead.

Fissure of the rectum should call for surgical, and not palliative, treatment. It is simple of cure by gentle divulsion of the sphincter-muscle. If the physician is averse to giving an anæsthetic for this purpose, he can practice moderate stretching several times with a small divulsor, and a rapid cure will be effected in the greatest number of cases. J. M. Mathews (*North Carolina Med. Jour.*, Apr. 20, '98).

Incision.—The incision should be made through the base of the ulcer and

a little longer than the fissure itself, so as to sever all the exposed nerve-filaments. The cut should divide the muscular fibres along the floor of the ulcer. In a fair proportion of cases this operation will meet with success, but it is not so certain to result successfully as the operation next to be described. It has the advantage over the other operations, however, of being nearly or entirely painless under local cocaine anæsthesia. When, therefore, general anæsthesia is contra-indicated or is refused by the patient, this method is worthy of a trial.

Dilatation and Incision.—This operation is a radical and unfailing cure. The bowels should be emptied by a dose of castor-oil and an injection, after which, under general anæsthesia, the sphincters should be dilated in the manner previously described. A straight blunt-pointed bistoury should then be drawn lightly across the surface, making a cut extending about an eighth of an inch above and below the limits of the ulcer and about a sixteenth of an inch in depth. Usually it is a good plan to curette the entire floor of the ulcer, in addition.

The after-treatment consists in keeping the patient in the recumbent position for twenty-four hours, keeping the parts cleansed, and applying iodoform. In a week or so the parts will be perfectly well.

Fistula in Ano.

Definition.—An unnatural channel leading from a cutaneous or mucous surface to another free surface or terminating blindly in the substance of an organ or part.

Varieties.—For all practical purposes we may divide fistulæ into the following four forms: (1) the *complete*, in which there are two openings, one in the rectum and one on the skin more or less remote

from the anus; (2) the *incomplete internal*, in which there is a communication with the cavity of the rectum by means of an opening in the mucous membrane, but none with the external surface of the body; (3) the *incomplete external*, in which there is an external opening through the skin, but no communication with the bowel; and (4) the *complicated*, or so-called complex, variety, in which there are many sinuses and numerous external openings. Some of these tracks run outward; some extend up the bowel beneath the mucous membrane; while others travel around the bowel and open in the other buttock, giving rise to the variety known as the horseshoe fistula. The second and third varieties named are frequently spoken of as blind fistulæ.

Symptoms.—Occasionally there is considerable pain, but more frequently only a feeling of uneasiness about the anus. When a fistula originates, as it most commonly does, from a pre-existing abscess, there is a sensation of weight about the anus, with swelling of the integument, considerable tenderness upon pressure, pain in defecation, and more or less constitutional disturbance associated with rigors.

The chief discomfort is the discharge, which varies in quantity and may be purulent or muco-purulent. This discharge occurs from the sinus so long as it remains unhealed, soiling the linen and making it wet and uncomfortable. It often produces an excoriation of the nates. The discharge is not of itself sufficient to be a source of great exhaustion and does not interfere with ordinary occupations, so that many patients have had fistula for a considerable length of time without being conscious of any serious ailment. The escape of flatus and mucus from the bowel in cases of

complete fistula will often prove a source of annoyance, as will also the passage of feculent matter, which will be expelled through the sinus should the fistulous channel be very free. An attack of secondary suppuration is always liable to complicate a fistula, and is usually due to a stoppage of the track by small particles of feces or by exuberant growth of the granulation. Such a sequel, of course, is attended with pain, until a new opening forms or one is made by the surgeon. In some cases the original fistulous track becomes re-established. Patients of neurotic habit often suffer mentally and from general weakness. As in other affections of the rectum, various reflex pains are experienced, which may be referred to the back, to the loins, and to the lower portion of the abdomen. When such pains extend down the leg and to the foot, they are liable to be attributed to sciatica, unless the history of the case is carefully studied and a critical examination is made.

Diagnosis.—Prior to the examination of the rectum the bowels should be emptied by an enema. This procedure not only renders the exploration of the parts easier and cleaner, but also, in women especially, serves to quiet the patient's fears of any untoward accident's occurring; and therefore facilitates the thoroughness of the surgeon's examination by securing the co-operation of the patient, as in extruding the parts, etc.

The patient should be placed in a recumbent position on a table or an examining chair, with the legs well drawn up toward the abdomen, and the buttocks brought to the edge of the couch. If the external orifice of the sinus is prominent, or if there is a sentinel granulation, the outlet of the fistula will be obvious; but when it is small and located between folds of the skin its situation may be

demonstrated by making pressure with the tip of the finger in the suspected locality, which will usually cause a little drop of matter to exude. The site of a fistula may often be detected by feeling gently all around the anus with the forefinger and finding an induration suggesting a pipe-stem beneath the skin. A flexible silver probe should now be passed along the fistulous track. In doing this considerable care is requisite and the utmost gentleness should be observed, the probe being directed by its own weight through the sinus and not forcibly. If it does not pass easily, it may be bent, and "coaxed" along the channel. In the majority of instances it will pass directly into the bowel. When the probe has passed as far as it will go without the use of any force, the finger is introduced into the rectum. When it comes in contact with the free end of the probe it demonstrates the presence of a complete fistulous track. In other cases the mucous membrane is felt to intervene between the finger and the probe; in such cases the internal opening generally exists, but it is difficult to discover,—sometimes because the examiner searches for it too high in the bowel. Palpation with the sensitive tip of the finger will often render the presence of the inner orifice obvious by coming in contact with an indurated mass of tissue. If such a spot be felt, the finger should be placed upon it and the probe passed toward the finger. There may not be an internal opening; if not, the operator should ascertain how near the probe comes to the surface of the bowel. If a doubt still exists as to the completeness of the track, any one of a variety of specula may be introduced into the rectum, and the outer orifice of the sinus injected with a solution of iodine, creolin, or of peroxide of hydrogen, when, if

there be an internal opening, the appearance of the fluid within the bowel will set the question at rest. If the inner opening be not discovered by these methods, the case must be looked upon as one of external rectal fistula.

Where there are numerous external openings it is necessary to probe all of them so as to determine whether they are connected and the direction which they take. Sometimes more than one internal orifice exists.

The presence of an incomplete rectal fistula is more difficult to determine than the other varieties of this lesion which have just been considered. It is the most painful form, but fortunately it is of infrequent occurrence. Its orifice may be located anywhere in the rectum, but it is generally found between the internal and the external sphincters. According to the Allinghams, the circumference of this opening is often as large as an English three-penny piece, its edges being sometimes indurated, at other times undermined. The fæces when liquid pass into the sinus and create great suffering—a burning pain often lasting all day after the bowels have acted. In this variety of fistula the fæces are coated more or less with pus or blood and a boggy swelling is noticed at some portion of the circumference of the anus. A peculiar feature of this swelling is often noted, viz.: its presence one day and its disappearance in a day or two, followed by an increased discharge of pus from the bowel. This is explainable by the closure of the outlet of the fistula caused either by a plug of fæces or as a result of inflammatory swelling which allows the collection of a quantity of pus and the consequent formation of the boggy tumor. The swelling disappears upon the re-establishment of the communication between the bowel and the sinus, and is

attended by the profuse discharge of matter previously mentioned. This phenomenon is repeated over and over again, and, as a rule, is a pretty positive indication as to the nature of the disease. In some cases of blind internal fistula, if the orifice can be felt or if it can be seen through a speculum, a bent probe may be introduced into it and made to protrude near to the cutaneous surface of the body, where its point can be felt.

Fistulæ frequently co-exist with other rectal diseases; it is, therefore, important that an examination should be carefully made, so as to exclude such lesions as stricture, malignant or benign; hæmorrhoids, tumors, etc. A thorough physical examination of the chest should also be made, to ascertain the presence or absence of phthisis, which so frequently complicates fistula in ano.

The following observations regarding the relation of fistula in ano to phthisis are noted: Tuberculous fistula of the anus is usually secondary to phthisis. Pulmonary tuberculosis is rarely, if ever, secondary to anal fistula before or after operation. Tuberculosis of the anal region should be dealt with as radically as when it attacks other organs. When the patient's *condition* permits, one should operate on fistulæ irrespective of kind. Operation should not be declined in persons suffering from chronic phthisis nor in those who give a family history of tuberculosis. Patients operated on for tuberculous fistula complicated by phthisis, and patients who are non-tuberculous, but suffer from some involvement of the lung, and who rapidly decline after the operation, do so from an inflammation of the lungs induced by the anæsthetic, especially ether. Such accidents have not followed operations in personal practice where local anæsthesia was employed. One is justified in discarding the teachings of writers who teach that the cure of a fistula will result in the development of phthisis. S. G. Gant (*Inter. Med. Mag.*, April, 1902).

Serious kidney disease should be ex-

cluded before recommending operation, for obvious reasons. In cases of caries of the vertebræ, of the sacrum, or of the pelvis, fistulous tracks may form and simulate anal fistula. In such instances a careful investigation will reveal the true origin of the trouble, and show that the case is not one of ordinary anal fistula.

Etiology.—Fistula in ano, which is not due to ulceration and perforation of the rectal wall from within, is the result of a previous abscess. Such an abscess forms in the ischio-rectal fossa, and although opened early by a free incision even before the cavity becomes distended with pus, it frequently fails to heal. It may fill up and contract to a certain extent, but it does not become obliterated; a narrow track remains, which constitutes the disease under consideration.

There are several reasons why rectal abscesses so frequently degenerate into fistulæ. One is that, owing to an internal opening communicating with the bowel, small particles of fæcal matter find their way into the sinus, and, acting as foreign bodies, prevent the healing; another, that, owing to the frequent movement of the parts by the sphincter-muscles, sufficient rest is not obtained for the completion of the reparative process; and, finally, the vessels near the rectum, not being well supported and the veins having no valves, there is a decided tendency to stasis, which is unfavorable to granulation.

According to Harrison Cripps, the surface of the fistulous track is lined with a smooth, gelatinous membrane, which, when examined under the microscope, is found to consist of granulation-tissue exactly analogous to that which lines the interior of a chronic abscess. The leucocytes constituting the outer wall of this membrane are but loosely adherent, and,

constantly becoming free, they form the chief part of the pus which drains from the fistula.

This disease is commonly met with during middle life, but it is by no means restricted to this period. The Allinghams state that they have operated upon an infant in arms and upon persons over eighty years old.

Course and Prognosis.—This disease, untreated, has a tendency to progress. The longer its duration, the more tortuous and complicated does a fistula become. Hence the earlier the patient submits to treatment, the more favorable will be the prognosis. Again, the time and extent of the treatment necessary to effect a permanent cure will be correspondingly diminished.

Treatment.—**PREVENTIVE.**—When a patient presents the symptoms of a threatened abscess in the vicinity of the rectum, he should be directed to go to bed, or at least to avoid all undue exercise; the bowels should be thoroughly evacuated, preferably by the use of a saline; the diet should be nutritious; and, if the case be seen early, hot fomentations and poultices may be applied to the parts. The early adoption of these measures may abort the threatened abscess, but very little encouragement can be given the patient.

If there be reason to suspect that pus has formed or is forming, it will be desirable to make a free incision into the centre of the affected site with a sharp, curved bistoury, if the trouble is superficial, or, if it is deep, with a narrow straight knife. When pus is present and is deeply situated, the evacuation of the abscess will be aided by the introduction of the forefinger into the bowel; the swelling may thus be pushed forward, rendered tense, and made more apparent.

In opening these abscesses, if possible,

ether or nitrous-oxide gas should be given. The patient should lie on the side upon which the threatened abscess is situated; the upper leg should be bent forward upon the abdomen. When pus is present, the operator should stand out of the line of its exit, for when the cavity is opened the pus often squirts out a considerable distance. After the matter has been discharged, the forefinger should be introduced into the abscess-cavity for the purpose of breaking down any secondary cavities or loculi that may exist. When this has been accomplished the abscess should be washed with bichloride-of-mercury solution, 1 to 4000, after which a rubber drainage-tube should be inserted; or a piece of iodoform gauze should be lightly placed between the lips of the incision, to prevent its closing too rapidly and also to allow free drainage. Careful daily attention should be paid to the wound while the cavity of the abscess is contracting, as it is important to maintain a free and dependent outlet for the discharge that may continue to be secreted, but stuffing and distension of the cavity should be avoided. If a drainage-tube be used, it should be shortened from day to day as the wall of the abscess contracts.

After an operation for rectal abscess the patient should be kept quiet for several days, and if great care be taken, both with the subsequent drainage and in keeping the orifice open, the parts may heal without the formation of a fistula.

PALLIATIVE TREATMENT will be required where there is a positive refusal on the part of the patient to submit to an operation, and in persons whose general health is broken down and in whom the reparative powers are inadequate. Chronic alcoholism, albuminuria, diabetes, malignant disease, etc., are conditions in which operative measures may

be attended with risk and in which it may be advisable to resort to palliative measures. Phthisis is not an absolute contra-indication to operative measures. The rule usually followed is to operate in those cases of tubercular subjects in which the disease is quiescent, but to avoid such interference if the lung mischief is active.

Incomplete external fistulæ and even complete fistulæ of somewhat recent origin and not extensively indurated may be cured by non-operative measures; but such treatment requires constant attention on the part of the practitioner as well as a willingness on the part of the patient to give sufficient time to the treatment. Even under such circumstances the process of repair is slow, and in many cases the result will not be perfectly satisfactory. It is true that fistulæ sometimes recover spontaneously or are cured by simple means, such as the mere passage of a probe used in examining the fistulous track; but instances of this kind are rare. In certain selected cases of fistula a cure may be effected by stimulating the sinus and allowing free drainage. This is done so as to avoid the use of the knife, when possible. To obtain satisfactory results the following indications should be borne in mind: That the external orifice should be perfectly free; that the sinus should be kept clean, so as to prevent putrefactive changes; that an effort be made to excite a healthy action in the fistulous channel; and, finally, that the parts be kept as quiet as possible. To meet the first indication, it is necessary to dilate the outer opening of the fistula with sponge or sea-tangle tents, or with Lee's antiseptic slippery-elm tents. The latter are made of selected slippery-elm bark and are compressed under high pressure. Owing to their non-irritating and demulcent properties,

they are to be preferred. The second indication (that the sinus be kept clean, so as to prevent putrefactive changes) is best carried out by the use of bichloride-of-mercury solutions 1 to 4000 or carbolic-acid solutions 1 to 80. Such solutions are injected into the sinus by means of a long, flexible silver cannula attached to an hypodermic syringe. The third indication (to excite a healthy action in the sinus) can be met in one of a number of ways. Anæsthesia of the channel with an injection into the sinus of a 2-per-cent. solution of cocaine, using the same syringe and cannula that are used for cleansing the fistula, is desirable. If the wall of the sinus is somewhat indurated, it is better to insert a small, flexible curette and scrape the wall of the fistula along its entire length; or Mathews's fistulatome may be used. The sinus is now prepared for some one of the various stimulating substances which have been recommended for this purpose. Among these may be mentioned tincture of iodine, 1 part to 4 of water; nitrate of silver, 20 to 60 grains to the ounce; sulphate of copper, a saturated solution, or carbolic acid mixed with equal parts of glycerin and water. These substances may be applied by means of cotton attached to a silver probe or to an applicator, or they may be injected into the sinus by means of a syringe and silver cannula.

If the fistula be a complete one and the substance used be applied as an injection, the finger should be passed into the rectum and made to cover the internal orifice of the sinus, so as to prevent the escape of any of the fluid into the bowel.

Regarding the fourth point (keeping the parts at rest), the patient, while under treatment, should be confined to the horizontal position either in bed or on a sofa; congestion of the parts is

thereby lessened. A firm pad placed over the anus and supported by a T-bandage is useful in limiting the motions of the parts, due to the alternate contraction and relaxation of the levator-ani muscle. The chance of success in the palliative treatment of this disease will be greatly increased if due attention be paid to the general health of the patient; when circumstances render it possible, a change of air should be advised.

Certain superficial or marginal fistulæ following fissures, or slight trauma, or very small abscesses, may heal, and heal permanently, if left to themselves and kept perfectly clean. Such cleanliness, however, must be persistent and scrupulous. Not only must the parts be washed at least once daily, and more often in warm weather, but they must be cleaned carefully after each movement of the bowels, and should be irrigated with some mild antiseptic or astringent, such as myrrh-wash or dilute liquor plumbi subacetatis. After the washing they must be made and maintained perfectly dry. After wiping out the sinus, filling it with some inert powder or with powdered boric acid is at times of undoubted benefit. Blake (*Boston Med. and Surg. Jour.*, Sept. 2, '97).

OPERATIVE TREATMENT. — The surgeon should examine the patient carefully, not only locally, but also as to the state of his general health, for fistula in ano is not infrequently complicated with other lesions which may render operative procedures inadvisable. Thus, when a fistula is associated with a stricture of the rectum of a malignant nature any operative interference on the former lesion will be out of the question. If it be a simple stricture and its existence be not recognized, or if it be not treated, any operation performed on the fistula will usually fail to effect a cure.

Incision.—In a number of instances

the operation which is sanctioned by experience as the most prompt, certain, and safest in its results is to lay open the sinus into the rectum, dividing with the knife all the tissues intervening between its cavity and that of the bowel. The bowels should be moved by means of castor-oil or some other mild cathartic on the day preceding the operation, and on the morning of the latter the lower bowel should be evacuated by means of an enema.

After etherization the patient should be placed on the side on which the fistula exists, the buttocks being brought to the edge of the table. Occasionally the lithotomy posture is preferable, as in cases in which there is a complex fistula. The first step in the operation is to dilate the sphincter-muscles slowly, but steadily, by introducing the thumbs into the rectum, back to back, and making gradual pressure around the anal orifice until the muscular contraction is overcome.

In dealing with complete fistulæ a flexible probe-pointed director is passed through the sinus, and is then brought out of the anus by means of the forefinger of the left hand introduced into the bowel. The tissues lying upon the director are then to be divided with a sharp bistoury. A careful search is now to be made for any diverticula, which, if found, should be divided. If none exist, the granulations lining the track should be scraped or cut away. The healing process will be greatly facilitated by removing with scissors all overtopping edges of skin and mucous membrane. If the internal opening be more than an inch from the anus, a probe-pointed bistoury should be introduced into the fistula upon a director and its point made to impinge upon a finger placed in the rectum. As the finger and

the instrument are withdrawn, the necessary incision is made. Or the director can be passed through the sinus and a wooden gorget inserted into the bowel, after which the track can be divided with an ordinary bistoury. The gorget prevents the opposite side of the bowel from being injured should the knife slip.

When the track of the fistula is much indurated and considerable force is therefore required to make the incision, it will be better to perform the operation by means of Allingham's spring-scissors and special director. With these instruments, fistulæ running high up in the bowel may be divided no matter how dense they may be. The director is made with a deep groove, the transverse section of which is more than three-quarters of a circle; in this the globe-shaped probe-point of one blade of the scissors runs. When placed in the groove the blade cannot slip out. The director having been passed through the sinus, the forefinger of the left hand is introduced into the bowel, and the probe-pointed blade of the scissors is inserted into the groove of the instrument and runs along it, cutting its way out through the diseased tissue as it advances, the finger in the bowel preventing the healthy structure from being wounded.

A frequent error in operating on fistulous cases consists in not keeping to the sinus, the director being pushed through the track-wall, and then being free to roam about in the cellular tissue of the part, at the operator's will. In this manner a portion of the fistulous channel is left, and an unnecessary amount of the tissues is divided. Such a mistake can always be avoided by taking plenty of time in performing the operation and by careful sponging of the sinus as it is laid open, in order to follow the track of the granulation-tissue lin-

ing it, which by this simple means is freely exposed to view.

The method of treating external rectal fistulæ must vary according to the direction and extent of the track. If the mucous membrane alone intervenes between the finger introduced into the bowel and a probe passed along the sinus, the channel should be transformed into a complete fistula by perforating the mucous membrane with the probe, or with a director, at the uppermost limits of the fistulous channel. The regular operation for complete fistula is then to be performed by dividing the intervening septum between the fistula and the bowel. In cases in which the sinus is directed away from the rectum, the proper course is not to divide the sphincters, but freely to enlarge the external orifice and to maintain free drainage.

The treatment of incomplete internal rectal fistulæ invariably demands operative interference at the earliest possible moment after a diagnosis is made, for if left alone its tendency is to burrow. The operation for this variety of fistula consists in making it a complete fistula and in dividing the intervening structures between the bowel and the sinus. This is best performed by introducing a probe-pointed director, bent at an acute angle, into the bowel, and passing the bent portion through the internal opening. This done, the point of the probe can be felt subcutaneously and cut down upon and the remainder of the operation completed.

In dealing with complex fistulæ the surgeon must be guided by the peculiarities of each case. In operating upon a horseshoe fistula it is important to recognize the true condition of affairs; for a careless or inexperienced observer might think that he had two separate fistulæ to deal with and operate accordingly.

Immediate Suture.—In otherwise healthy subjects, a method of operating which has met with success, especially in this country, consists in the immediate suture of the wound after the fistula has been excised. The steps of the operation are as follow: the septum between the fistula and the bowel is divided; the entire fistulous channel and all lateral sinuses are excised; buried sutures of catgut, silk-worm gut, or of silk are then inserted beneath the wound and around its circumference at intervals of a quarter of an inch and tied so as to bring the deep tissues together. The sutures are inserted very much in the same manner as in the ordinary operation for ruptured perineum. The advantage of this plan is that primary union is secured and the patient recovers in a shorter time than would have been the case after one of the operations which aims to secure union by granulations. The wound now and then becomes infected, however, probably from its proximity to the bowel and its consequent liability to infection from the entrance of fæcal matter. At all events, this complication has occurred so often in my experience that I would advise extreme caution when this procedure is employed, for if the presence of pus is not promptly recognized, the state of the patient is worse than prior to operation.

Ligature.—There are two methods of using the ligature, which we may term the immediate and the mediate. The immediate operation has little to commend it. It consists in passing a silk thread through the fistula and drawing it backward and forward so as to cause it to cut its way through. The same object may be accomplished by the use of the galvanic écraseur or of the wire écraseur of Chassaignac. In mediate

operation by the liagture either the silk ligature or an elastic one may be employed. If the silk be employed, it may be used in one of two ways: In both methods a short piece of silk is threaded to a silver probe bent to a curve, which is passed through the fistula and drawn out at the anus. The thread is passed through the track so that one end hangs out of the bowel and the other at the external orifice of the fistula. It is at this point that the methods diverge. One plan consists in knotting the ends loosely together and allowing the patient to go about. After a time, ranging from two to four weeks, the ligature comes away, having slowly cut through the included tissues. According to Harrison Cripps, the pathological process by which this is accomplished appears to be a gradual destruction or disintegration of the included tissue, due to the ulcerative action of the thread. The other plan is to tie the silk so tightly that it will completely cut its way through and strangulate all the tissue requiring division in an ordinary case of fistula. This method causes considerable suffering to the patient and has therefore been discarded in favor of the operation next to be described.

Elastic Ligature. — The advocates of the elastic ligature maintain that it does not give rise to hæmorrhage. This is a matter of considerable importance when the fistula penetrates deeply, and also in those rare cases of hæmorrhagic diathesis, in which severe bleeding is apt to follow a trivial incision. The elastic ligature, for which we are chiefly indebted to Dittel, of Vienna, causes strangulation by the firm pressure it constantly exerts upon the included structures; it cuts its way out in a week's time or less. It is stated, by those who have had an extended experi-

ence with this plan of treatment, that, contrary to what might be expected, the pain attending the ulceration of the band through the tissues is slight, especially after the first twelve hours. Consequently, this method would prove an excellent way of treating fistula if it were to be relied upon to effect a cure. Unfortunately, this is not the case, for it often happens that after the ligature has cut its way through, and the superficial parts have healed, the fistula remains uncured. The reason for this is to be found in the fact that the ligature has dealt with the main track only of a fistula in which exist one or more secondary channels or diverticula. It is, therefore, a measure to be resorted to only when there is an insuperable dread of any cutting operation; when the fistula is uncomplicated with branch sinuses; in cases of deep fistula in which there is danger of wounding large vessels; in cases in which the patients are debilitated by some chronic disease; and, finally, in patients of known hæmorrhagic tendency. It is a valuable adjunct to the use of the knife in dealing with cases in which a sinus runs for some distance along the bowel toward the superior pelvi-rectal space.

The method of employing the ligature is as follows: A solid India-rubber cord about one-tenth of an inch in diameter is threaded to a probe having at one end a rounded opening or eye through which the ligature is passed. The probe enters the fistula from the external to the internal opening, and passes out through the anus. To facilitate the passage of the cord, the rubber should be put on the stretch. After the ligature is passed a soft metallic ring is slipped over the two ends of the cord; the cord is then tightly stretched and the ring slipped up as high as possible and clamped. If the internal

opening be any distance up the bowel, the instrument devised by the Allinghams facilitates the passage of the ligature. It is intended to draw the cord from the bowel out of the external orifice, and not *vice versâ*. Frequently by the time the cord separates the wound has become quite superficial.

AFTER-TREATMENT.—After the operation the wound should be packed with iodoform gauze and left undisturbed for twenty-four hours, to prevent subsequent hæmorrhage. A pad of gauze, over which carbolized oil is spread, and cotton and a T-bandage are next applied. The subsequent dressing of the case should be daily attended to by the surgeon himself. The parts should be kept perfectly clean, and the wound syringed with peroxide of hydrogen; carbolic-acid solution, 1 to 80; or a 2-per-cent. solution of creolin. After this a single piece of iodoform gauze laid between the cut surfaces of the wound will be all the dressing required. The healing process may be greatly retarded by excessive packing of the wound with lint, or delayed by the undue use of the probe. Such interference is to be avoided. If the granulations be sluggish and the discharge be thin and serous, it will be well to apply some stimulating dressing such as resin cerate with 20 grains of iodoform to the ounce, or a weak solution of copper sulphate (2 grains to the ounce), etc.

The surgeon should be on the watch during the healing process to avoid any burrowing or the formation of fresh sinuses. Should the discharge from the surface of the wound suddenly become excessive it is evident that a sinus has formed, and a careful search should be made for it. Sometimes it begins under the edges of the wound, at other times at the upper or lower ends of the cut surface, and occasionally it seems to

branch off from the base of the main fistula. Pain in or near the seat of the healing fistula is another symptom of burrowing; when complained of, the surgeon should carefully investigate its cause.

After an operation for fistula the patient's bowel should not be confined by the use of an opiate. The natural dread on the part of the patient, of experiencing pain, the result of a movement of the bowels, will be sufficient to inhibit any action, and the usual experience of the rectal surgeon is that a laxative will be required. The bowels should be moved on the third or fourth day. So soon as the patient feels a desire to go to stool an enema of linseed-oil (6 to 8 ounces) should be given, which will tend to render the fæces soft and fluid and hence render their passage easier. The patient should be kept in a recumbent posture until the fistula is healed; and until the bowels are moved the diet should be liquid: milk, beef-tea, and broths. The time required for a patient to recover after an operation for fistula in ano varies with the extent of the disease. In an average case it will be necessary to keep the patient in bed for two or three weeks and confined to the house for several weeks longer. Many cases may be operated on in the office under local anæsthesia; such cases may get well without being confined to the house.

Much hæmorrhage rarely follows an operation for fistula, but in some cases it may be necessary to ligate a large vessel. If there should be a profuse general oozing, the sinus may be packed with iodoform gauze, or, if necessary, the rectum may be plugged; for this purpose the Allinghams tie a string into the centre of a large, bell-shaped sponge, which is passed into the bowel so as to prevent the blood from escaping upward

into the colon. They then firmly pack the parts below with cotton dusted with powdered alum or persulphate of iron. In order to allow the escape of flatus, a catheter may be passed through the centre of the sponge. As a rule, all hæmorrhages following rectal operations are easily controlled by mild measures, such as the local application of hot water, of ice, or of some mild astringent.

Incontinence of fæces is happily of rare occurrence, and follows only extensive operations, especially those in which the sphincter has been divided more than once. When it exists to any extent, it is productive of great annoyance to the patient, possibly more so than the original fistula. The application of the small point of the Paquelin thermocautery to the cicatrix of the operation-wound will often suffice to relieve this trouble, by causing contraction of the anal outlet and giving tone and increased power to the sphincter-muscle. The Allinghams recommend for this condition freeing the ends of the muscle by a deep incision through the old cicatrix and allowing the wound once more to heal from the bottom by granulation. Kelsey advocates complete excision of the cicatrix, exposing freely the divided ends of the sphincter and bringing them together by deep sutures, exactly as in cases of lacerated perineum.

A new operation for anal fistula. Under general anæsthesia an incision is made antero-posteriorly, about two inches long, near the centre of the opening of the fistula, but the cut going a little to one side. The skin and fascia are cut through, and the muscular fibres are separated longitudinally by an Allis dry dissector or by the handle of the scalpel. The nerves and vessels are retracted, and the separation of the muscular fibres is continued alongside of the fistulous tract until the gut is reached; the fistulous opening in the latter is then excised or sutured, the stitches only in-

cluding the serous coat. The entire fistulous tract is then dissected out and the wound closed in the usual manner. The after-treatment consists in keeping the bowels at rest. The advantage of this operation is that it does away with section of the anal sphincter, which often leaves a patient in a worse condition than the fistula. R. D. Fairex (Inter. Jour. of Surg., April, 1901).

Pruritus Ani.

Symptoms.—This may be classed among the most annoying of the minor affections. Though not painful, nor dangerous to life, it may produce marked ill health by interfering with rest. The severity of the disorder varies considerably, ranging from irritation to intolerable itching. Usually the pruritus occurs at night after the patient retires, and lasts hours.

The itching may be so intense that it is almost impossible to avoid scratching, which, instead of giving relief, adds to the trouble. Nervous and excitable persons are prone to attacks of pruritus during the day as well as at night, especially after exercise or on leaving the cold air and coming into a warm room. In marked cases a characteristic condition is the loss of the natural pigment of the part. The skin is not supple, but has a peculiar harsh and rough feel similar to that of parchment-paper. It is frequently fissured from scratching.

Etiology.—The causes are both local and constitutional. In many cases it is impossible to discover any causative factor, and it may then be considered, as stated by the Allinghams, as a pure neurosis, occasioned or greatly aggravated by mental worry or overwork. Leucorrhœal discharge often excites pruritus by remaining in contact with the skin of the perineum and developing an eczema. In children, especially, it may result from the presence of *Oxyuris vermicularis* in the rectum. Pediculi, or scabies,

may also occasion it, or it may be excited by improper diet and highly-seasoned food.

Hæmorrhoids, polypoid growths, fissure, or fistula, from the irritation they set up and the abnormal secretion they produce, and chronic diarrhœa or dysentery, may occasion pruritus. Erythema, herpes, and any variety of eczema, whether acute or chronic, may also give rise to it. It has also been traced to stricture and inflammation of the upper portion of the urethra. It frequently depends upon a varicose condition of the hæmorrhoidal veins, just as occurs in a similar condition of the veins of the lower extremity. Uterine disorder, uncleanness, and insufficient ablution of the anus, and, finally, the use of hard or printed toilet paper may excite it.

Gouty subjects and persons with a more or less marked lithic-acid diathesis are predisposed to attacks of pruritus ani. Hepatic disorders, which may or may not be associated with constipation, diabetes, and chronic constipation, frequently act as causes, while excessive smoking and the free indulgence in alcoholic liquids or of coffee may also induce it. Excesses at the table, combined with a lack of proper exercise, not only predispose to pruritus, but also may become its exciting cause. It has also been ascribed to disease of the spinal cord and brain.

Treatment.—In the majority of instances, especially if there be no ascertainable local factor present, the affection must be treated by constitutional remedies as well as by local means. The Allinghams state that the difficulty experienced in its treatment has arisen in a great measure from its having been considered as merely a local affection, and only local means having been applied for its relief.

If the patient shows a lithæmic tendency he must be treated accordingly. Out-of-door exercise should be advised; the diet should be carefully regulated; meats should be taken in small quantities. Rich gravies, sauces, and pastry are to be avoided, as well as all sweets; malt liquors and all wines except claret are objectionable.

Turkish baths are beneficial when taken once or twice a week. Massage is also of advantage. Medicinally the lithium salts are indicated, either in the form of the natural mineral waters or the effervescing lithium-citrate tablet. In cases in which the irritation is very severe, the wine of colchicum, in doses of 5 to 20 minims, every four to six hours, answers best. Cripps recommends the following formula of Brodie's:—

R Magnesia, 6 grains.

Potassium bicarbonate, 15 grains.

Potassium tartrate, 10 grains.

M. Sig.: To be taken with water twice daily, three hours after meals. The second dose may be taken with advantage on going to bed.

This must be persevered in for at least ten days in order to properly test its efficiency.

The Allinghams found that when gout, active or latent, was the cause of pruritus ani, the irritation was best allayed by the local use of a strong solution of sodium bicarbonate or of sodium disulphite (1 drachm to the fluidounce of water) frequently applied in a poultice.

In functional derangement of the liver, if dependent upon a gouty diathesis, the diet should be carefully regulated. The use of alcohol should be restricted. Considerable benefit is to be derived from the use of aperient medicines, of which the salines are the best, as sodium phosphate or the sulphate or the natural mineral waters. In some cases

marked improvement results from the use of mercury in some form, such as the fractional doses of calomel or blue mass in 5- or 10-grain doses. Ammonium chloride in 10- to 15-grain doses, four times daily, is a useful remedy in hepatic congestion. Nitrohydrochloric acid in combination with nux vomica and compound tincture of gentian or of cardamom often proves of value.

When chronic constipation is present the first step in correcting this condition is to instruct the patient to go at a certain hour every day to the closet, whether the desire exists or not. In most instances a morning hour will prove best, either before or after breakfast. Physical exercise is another important factor.

Certain articles of food are often of value, such as the fruits, of which apples, prunes, and oranges are the best.

No one plan can be outlined that will benefit all, or even the majority of persons afflicted with constipation. The individual indications are the only means by which we can successfully gauge the remedies required. Some authorities are strongly opposed to the continual use of laxatives in cases of obstinate constipation, but without their employment some patients would never have a bowel movement. Many inordinately use cathartics and laxatives, but this fact offers no valid objection to their employment by the physician when other means have been fruitlessly tried. Sometimes a tumblerful of hot or cold water taken before breakfast will regulate the bowels. If this should fail, the mineral waters may be tried, especially the Hunyadi Janos, a wineglassful of which, followed by a half-tumblerful of hot water, may be taken. Fluid extract of cascara sagrada, with equal parts of glycerin, in doses of 30 to 60 drops at bed-time, will

often prove useful. (See also CONSTIPATION, volume ii.)

In intractable cases of pruritus ani the urine should be examined for sugar.

The Allinghams state that when pruritus is of neurotic origin, as they think it frequently is, particularly in spare and delicate, excitable people, arsenic and quinine should be freely given, separately or combined. They should be pushed to their physiological effects. The internal use of opium in any form is contra-indicated. Most authorities agree that though a night's rest may be procured by its employment, its use aggravates the disorder.

LOCAL TREATMENT.—The pruritus induced by uterine catarrh can only be permanently removed by the cure of the prime factor in its causation. Relief from the itching can be afforded by cleanliness, frequent washing of the parts, and by the use of vaginal douches. Various sedative applications may be tried, such as 1 part of the officinal solution of plumbic subacetate to 4 parts of water, applied three or four times daily by means of cotton pledgets; or a lotion composed of 1 ounce each of chloroform, tincture of aconite, and tincture of opium and 6 ounces of olive- or linseed-oil, which is to be shaken well before using and is to be smeared over the parts whenever the pruritus becomes annoying.

The elimination of *Oxyuris vermicularis* and the relief of any cutaneous inflammation about the anus which their presence has occasioned will materially assist the cure of the pruritus. To destroy the worms it is not sufficient to rely entirely on rectal medication, such as enemas of lime-water, weak solutions of quinine (20 grains to the pint of water), or of corrosive-sublimate solutions (1 part to 4000), for these only ac-

comply with the destruction of the parasites in the rectum. In addition, it is essential for their complete eradication to add internal medication, so as to reach the seat of their propagation in the small intestine. (See PARASITES, INTESTINAL.)

When pruritus is caused by animal or vegetable parasites, it is readily cured by the application of the sulphur ointment, gently rubbed over the affected area at bed-time. The ointment should contain from $\frac{1}{2}$ to 1 drachm of sulphur to the ounce of benzoated lard, and it should be employed every night for a week or ten days. The use of strong sulphur ointment for any great length of time is injudicious, as the cutaneous surface of the parts is apt to become irritated. A cleaner and an equally efficient remedy advised by Messrs. Allingham is a lotion of sulphurous acid of the strength of 1 part to 6 of water.

The removal of hæmorrhoids, poly-poid growths, fistula, and fissure will enable remedies applied for the relief of a pruritus to affect a cure, when otherwise the disease will prove intractable. J. M. Mathews ("Diseases of the Rectum," '92, pp. 494-97) alludes to a fact which is worthy of emphasis, viz.: that when pruritus is established, the treatment of any organ or local condition which caused the affection will not cure the pruritus.

The pruritus associated with varicose veins of the rectum may be relieved by measures calculated to tone up the part and to lessen any tendency to congestion. Bathing the anus night and morning and after a movement of the bowels will often accomplish this purpose. To prove efficacious a sponge must be soaked in cold water and squeezed dry by pressing it against the anus. This procedure must be repeated about a dozen and a half or more times at each bathing. Another excellent treatment is to use an

injection into the bowel daily of about 2 drachms of the following formula:—

R Fluid extract of hamamelis, 1 fluidounce.

Fluid extract of ergot, 2 fluidrachms.

Fluid extract of hydrastis, 2 fluidrachms.

Compound tincture of benzoin, 2 fluidrachms.

Carbolized olive-oil or linseed-oil (oil, 5-per-cent. carbolic acid), 1 fluidounce.

M. Shake well before using.

Sig.: One to 2 drachms as an injection.

Pruritus Ani per se.—All discoverable local or constitutional causes of this disease having been excluded, we are brought to the consideration of a class of cases, by no means small in number, to which the term "neurotic" has been applied. That the condition is due to a neurosis, reflex or otherwise, is a little difficult to confirm, but it is a plausible explanation, and is a theory warmly advocated by Mathews. These cases often tax the physician's resources to their limit. What relieves one patient will utterly fail in another, and what gives relief for a time may lose its effect entirely. Furthermore, it is impossible to state, with any degree of precision, as to the form in which remedies should be used, for, as stated by the Allinghams, "in cases which appear best suited to ointments the ointments may utterly fail, and a powder which you feared would be utterly useless may effect a cure." Therefore they advise their readers "to ring the changes between ointments, lotions, powders, and caustics."

Hot water applied as hot as can be borne to the region of the anus, while

it may temporarily increase the itching, acts as a temporary relief when employed at bed-time, provided the parts be not rubbed. It also paves the way for the application of other remedies, by making the parts more susceptible to their action.

Among the curative remedies recommended may be mentioned black wash, nitrate-of-mercury ointment, nitrate of silver in solution, chloroform, compound tincture of green soap, carbolic acid, calomel ointment, balsam of Peru, tincture of aconite and of belladonna (equal parts), camphor and carbolic acid (equal parts), menthol, and the hyposulphite of sodium.

The treatment which tends to the best results is a light breakfast, no luncheon, a good dinner, plenty of hot water an hour before and between meals, and correct habits. One method is conducive to the best results in all cases where no exciting cause or causes remain: that of stretching the rectum under anæsthesia for from three to five minutes. After this, a sharp curette should remove every vestige of the thickened and parchment-like membrane. Mathews (*Dunglison's Col. and Clin. Rec.*, Aug., '98).

Combination most relied upon: Carbolic acid, 10 to 20 parts; salicylic acid, 2 to 10 parts; boric acid, 5 parts; glycerin or cold cream, 100 parts. There is always an existing cause for the disturbance, and this should earnestly be sought and relieved. Ichthyol may be used with benefit when there is pain. J. P. Tuttle (*Med. News*, Jan. 27, 1900).

Prolapse of the Rectum.

The term "prolapsus," or "procidencia recti," signifies a protrusion through the anus of any part of the rectum, consisting of mucous membrane, either alone or combined with one or more of the coats of the bowel. Occasionally the protruded part contains within its folds a loop of the small intestine.

There are three forms of rectal pro-

lapse: (1) prolapse of the mucous membrane alone [partial prolapse]; (2) prolapse of all the coats of the rectum [procidencia recti]; and (3) prolapse of the upper portion of the rectum into the lower, called invagination, or intussusception, in other parts of the intestinal tract.

Prolapse of the Mucous Membrane.—

In this variety the mucous membrane only is extruded, sliding away, as it were, from the muscular coat by the stretching of the loose submucous tissue which connects the two coats. The prolapse, in these cases, is necessarily limited, the protrusion being seldom more than an inch or two in length. This condition may occur at any age, though it usually occurs at the two extremes of life.

Symptoms.—The prolapse may be immediate as a result of vomiting, coughing, etc., or it may come on more gradually. The more the bowel is protruded, the more the parts become stretched and relaxed and favor the repetition of the descent of the rectum. When the attack comes on suddenly, there is apt to be considerable pain, and a tumor-like mass, red in color, projects from the anus. Frequently, blood is seen oozing from its surface. If the prolapse be of one that has often occurred, the mucous membrane shows evidences of superficial catarrhal ulceration. In some instances the submucous inflammation causes the surface of the protrusion to appear perfectly smooth, but usually the mucous membrane appears as bright-red folds, with sulci between them, which radiate from the anal aperture. At first the protrusion only occurs at stool, and is readily reduced; in some cases it becomes spontaneously reduced. In chronic cases it becomes more difficult to replace, and may occur independent of fecal action. In these cases the mucous membrane is

greatly thickened and the submucosa more or less infiltrated; a muco-purulent discharge is common, while bleeding, though slight, often occurs. The protrusion of internal hæmorrhoids is frequently associated with prolapse of the mucous membrane; this condition, however, ought always to be readily distinguished from the disease under consideration. Hæmorrhoids are more isolated and are much firmer to the touch.

COMPLETE PROLAPSE, OR PROCIDENTIA RECTI.—When partial prolapse has repeatedly occurred, it is apt to result in the more serious form, in which all of the tunics of the bowel are involved. In some instances an extensive prolapse takes place suddenly as a result of violent straining. In both conditions the tumor forms a protrusion of variable size, more or less pyramidal in form, which projects from the anus. At its distal end is the opening into the bowel, and this opening is generally narrow and slit-like.

When the prolapse involves more than two and a half inches of the rectum, it is well to remember that the peritoneum may be involved, and that within this serous sac and included in the prolapsed portion of the rectum a coil of the small intestine may be found. In this variety there is no invagination. This form of prolapse may assume extensive proportions, the greater portion of the colon being extruded.

The symptoms of complete prolapse are similar to those in the first variety, but are usually more aggravated. Mucus is present, and even pus may be found when this condition is associated with ulceration. Pain, when present, is not usually severe, as the mucous membrane here seems to be purposely endowed with a lowered sensibility. This fact accounts for the considerable amount of trauma

which the rectal mucous membrane stands without producing much suffering, as is exhibited in advanced and extensive malignant disease of the rectum. When the peritoneal coat of the intestine is involved, the sac of the hernia, so called, is to be looked for upon the anterior surface of the protrusion, as the peritoneal pouch does not descend nearly so far upon the posterior as upon the anterior wall of the rectum. Where the protrusion measures more than three inches, Ball states that the mass is generally curved, the concavity looking toward the coccyx, and in extreme cases it may be arranged in a more or less spiral manner.

PROLAPSE OF THE UPPER PORTION OF THE RECTUM INTO THE LOWER.—This disorder is called “invagination” or “intussusception” in other portions of the intestinal tract. It is described by J. M. Mathews as one “where the finger can be inserted into a groove alongside of the base of a tumor so that a distinct sulcus is recognized, of more or less depth, at the bottom of which, if not too deep, the lining membrane of the gut can be felt as it is reflected from the base of the protruding mass.” In such a case the rectum has begun to fold upon itself; in other words, to become invaginated, or “telescoped,” the upper part of the bowel always passing within the lower, at a point more or less distant from the anus, yet generally within the reach of the finger. This subject has been considered in the article on OBSTRUCTION, INTESTINAL, volume iv, and is mentioned here only for the sake of emphasizing the importance of recognizing the condition, especially as its treatment from a surgical stand-point differs materially from the operative procedures to be advised for the relief of the other two varieties of prolapse.

Diagnosis.—Though it is a compara-

tively simple matter to diagnosticate a prolapse, mistakes are frequently made. In children polypoid growths are more frequent than the literature would seem to indicate. In the adult hæmorrhoids may be mistaken for prolapse. Mathews suggests, in doubtful cases, that the adult patient be instructed to take an enema and to strain. If it be a prolapse of the mucous membrane, it will occupy the most or all of the circumference of the bowel, with a certain degree of regularity. The gut will be of a bright-red color, and if grasped between the fingers its folds can be easily pressed together, there being no well-formed tissue existing. In protruded hæmorrhoids the prolapse is irregular and does not include the circumference of the bowel, and oftentimes exists only on one side; and if the parts are seized a well-organized tumor can be felt, which can be circumscribed; the color is usually a dark blue. Another point to which Mathews directs attention is the size of the protruding mass. Simple prolapse is never very large, and where any of the coats of the rectum or all of its coats are included, the protrusion is much larger. A simple prolapse of the bowel does not usually remain out for any length of time, and a prolapse containing the coats of the rectum is very apt to remain out an indefinite time, or until reduced.

Etiology.—Straining at stool is the most frequent exciting cause. Children are especially predisposed to prolapse, because the rectum is nearly vertical and the mesocolon is of considerable length. The unfortunate habit of placing a child upon a commode and leaving it there for a long time to establish regularity of habit is a rather common cause of prolapse. Stone in the bladder and phimosis, by the straining efforts produced at urination, are factors not to be

overlooked in searching for the cause of this disease. It is often due to ascarides, to rectal polypi, and to violent fits of coughing, as in whooping-cough.

In adult life the causes of prolapse may be traced to some cause which leads to unnecessary straining efforts, such as enlarged prostate.

Prognosis.—When the mucous membrane alone is involved, a spontaneous cure is frequently effected; in children this result is more especially noticed. Mild measures often assist Nature. In the aged or in the young, where hypertrophy has occurred to any marked extent, operative measures are usually required to insure recovery. It is well not to promise too much to these patients as to the time necessary to effect a cure, as some cases respond but slowly to treatment.

Treatment.—No matter what variety of prolapse we are dealing with, efforts should be made to return the mass as speedily as possible. In some cases considerable difficulty may be experienced. Children should be laid across the knees and the entire mass should be subjected to gentle, but steady, pressure for some moments, so as to reduce the bulk of the tumor by the squeezing out of the fluid contents. The central portion should be returned first; this is best accomplished by inserting the finger into the lumen of the gut; then, by pressure of the fingers of the other hand, the remaining portions of the bowel may be gradually pushed within the anus. Persistence in taxis will in nearly all cases suffice. In some cases artificial supports are needed. A belt may be placed around the waist and an elastic band, having a solid or inflated pad attached, is passed between the thighs in such a manner as to press the pad against the anus. The anterior part of the band is divided so as to come

up to the belt in front of each side of the genitals. Another form consists of a belt, half steel and half leather, buckled about the hips just above the trochanters, while a bent steel spring passes down behind and carries a pad to press against the anus. In temporary cases, it assists the stability of the pad to draw the nates together with a broad strip of adhesive plaster. (Andrews.)

S. B. Powell recommends a plan which "consists in rolling in and strapping the buttocks together with two strips of adhesive plaster, extending sufficiently forward to secure a good hold. The child (or adult) defecates with these in position, is thoroughly cleansed after the act, and new strips are applied. This method, which, in the hands of the inventor, has never failed, is based upon the fact that the relaxed sphincter is elevated and supported during the strains put upon it while the child is at play, and is protected from the lateral traction occurring in the squatting position assumed in defecation. It and the parts above gradually regain their contractile power, and ultimately become competent to fulfill their functions normally." (Andrews.)

In all cases attention should be paid to regulating the actions of the bowels, and, instead of permitting the patient to sit in the usual position, defecation should only be permitted either in the recumbent posture, lying upon the back or side, or while the patient is standing. It is also of assistance for the patient to become accustomed to having the movement of the bowels occur the last thing before retiring, so that rest may be obtained immediately thereafter.

If possible, the cause of the prolapse should be ascertained. A catarrhal condition of the rectum, a polypus, oxyurides, a phimosis, or a stone in the blad-

der should always receive the proper treatment before a satisfactory result can be obtained in dealing with the prolapsus.

Astringent applications for the relief of prolapsus are generally useless. Cold water applied to the anus, either with a sponge or as a douche, is as serviceable a remedy as any drug. The astringent remedies advised, in this connection, are: alum, tannin, sulphate or chloride of zinc, chloride of iron, etc.

In chronic prolapsus and the introduction of fragments of ice into the anus during the reduction of the prolapse has always been successful even in the gravest cases. The suppositories should be cone-shaped, artificially frozen, measure $2\frac{3}{4}$ to 3 inches in length, and in diameter at the base 1 to $1\frac{1}{4}$ inches. One of these is enveloped in a piece of iodoform gauze, which should cover it like a glove-finger, and is pushed into the centre of the prolapse, which can thus be readily reduced, the ice and gauze being carried up with the protruded bowel. Usually no painful sensation is produced and the tampon is not expelled. After each defecation a new gauze and ice tampon is introduced. The prolapse occurs more and more rarely, and soon ceases. This result is due to the relief of congestion and the increased contractility of the rectal tissues under the influence of the mechanical and thermic excitation. Hajeck (*Revue Men. des Mal. de l'Enf.*, Nov., '99).

Cauterization, either by the actual cautery or by the employment of the nitrate-of-silver stick is a very satisfactory method. Excision of elliptical strips of the mucous membrane is sometimes necessary and often suffices for effecting a cure. Hypodermic injections into the coats of the bowel is not to be advised. Vidal, quoted by the Andrews, has used ergotine, in this manner, with asserted success.

König's operation for prolapse of the rectum consists in narrowing the anal aperture. A wedge-shaped piece is re-

moved from the edge of the anus, the elliptical incision being so made that one end lies within the anus and the other end on the outer skin. The excised wedge includes skin, mucous membrane, areolar tissue, and muscle. Care must be exercised in sewing up the deeper portions of the wound. Six cases were thus operated on and in two, after nine and three months, respectively, a slight return was noticed. In the others, up to the present time, no prolapse had occurred. C. Francke (Deut. Zeit. f. Chir., Mar., '99).

The treatments to be recommended are: 1. For prolapse of the mucous membrane only: reclining posture, adhesive straps, cauterization, or amputation. 2. For reponible, non-ulcerated prolapse of all the coats of the rectum and colon invagination, the cause is to be removed, if possible, massage and electricity being tried. Should these fail, colopexy is indicated. 3. For incarcerated irreponible ulcerated prolapse: circular resection, according to the technique of Mikulicz and Nicoladoni. The operation of colopexotomy, procto-coccyx, procto-sarco-coccyx, procto-sarcopexy, Gersuny's twist, and the circular suture of Thiersch are rarely indicated. J. Rawson Pennington (Cleveland Med. Gaz., Aug., 1901).

Non-malignant Ulceration.

It is a matter of surprise that erosions of the mucous membrane of the rectum are not more frequently produced and become the starting-points of ulceration, as a result of the irritation to which the bowel is exposed from the presence and passage of faecal matter. It is true that ulceration frequently exists and is not recognized; but, nevertheless, its frequency, compared with that of other rectal lesions, is extremely limited.

Symptoms. — Ulceration within the rectum, as a rule, occasions well-marked, though in no sense essentially pathognomonic, symptoms. The same signs are often observed in cases of stricture of the rectum. The doubts as to the nature of the trouble may readily be cleared by

making a digital examination. The symptoms noted are pain, tenesmus, diarrhoea (often alternating with spells of constipation), and discharge. These also suggest dysenteric attacks, and it is no unusual experience to see cases of ulceration treated for dysentery.

Cripps (*op. cit.*, p. 193) states that the degree of pain experienced is no indication of the severity of the disease, the suffering depending on the situation of the lesion rather than on its extent. Generally speaking, the nearer the anus it is situated, the greater the pain. This is well exemplified in cases of irritable ulcers of the anus. In ulceration involving the anus, loss of control of the sphincters often occurs.

The diagnosis will receive due attention when the individual varieties of ulceration will be discussed.

Etiology. — Non-malignant ulcers of the rectum are usually classified into (a) the varicose; (b) the traumatic; (c) the dysenteric; (d) the irritable [the so-called fissure of the anus]; (e) the catarrhal, or follicular; and (f) those arising from general debility occasioned by Bright's disease, phthisis, diabetes, and starvation; also into (g) the tuberculous; (h) the so-called rodent ulcer; (i) the chancreoid; and (j) the syphilitic.

The existence of the *varicose* and the *traumatic* varieties seems to be unquestioned by all authorities. It is true that varicose veins of the legs are often followed by ulceration, and that a similar condition of the hæmorrhoidal plexus of veins is the precursor of ulceration of the rectum, which should be classed in the category of the predisposing causes of all ulcerations in this region. In all conditions which lead to ulceration primarily, the condition is attended by varicosity of the rectal vessels, which induces a stasis of the blood-supply, fol-

lowed by congestion. Under these circumstances it is not likely that an ulcer of the bowel will occur without some form of traumatism.

The *traumatic* ulcer may be produced in a variety of ways, as from the introduction of foreign bodies through the anus; but much more frequently the initial laceration or abrasion is occasioned by hardened fecal masses, pieces of bone or wood, nut-shells, or some similar substance. Pressure of the foetal head during childbirth is a not unlikely cause. Retarded union following operative interference upon the rectum for the removal of hæmorrhoids, polypi, etc., is another factor in producing ulceration.

The *dysenteric* variety, in the opinion of J. M. Mathews, is rare. He states that "if a long-continued irritation is kept up in the rectum from any cause, the result would be, of course, an inflammatory exudate, resulting, perhaps, in ulceration and stricture," but he states that, in searching for this as a cause, the evidence has not been such as to enable him to place it in the list as a cause at all for stricture of the rectum. What this distinguished author has to say upon the subject of dysentery as a cause of rectal stricture applies with equal force to ulceration. An attack of dysentery may, and often does, act as a predisposing factor in causing an ulceration of the bowel, but that we have a class of ulcers to which we can apply the term dysenteric I very much doubt.

The *irritable ulcer* of the rectum, known more commonly by the term "fissure of the anus," has been thoroughly reviewed.

Follicular, or catarrhal, ulceration may, according to Ball, occur in any part of the colon, but the seat of election is undoubtedly in the rectum and the sig-

moid flexure. The solitary follicles become inflamed and disintegrated, and finally open upon the surface of the bowel, owing to the necrosis of the swollen tissue. Though small at first, these openings gradually enlarge, and small ulcers are formed, which do not tend to heal, but spread, and finally involve the submucous tissue. These ulcers also spread by uniting. In some instances the muscular coat of the bowel has been perforated and the ulceration has extended into the bladder and the vagina.

Ulceration involving the rectum and arising from the *general debility* occasioned by Bright's disease, diabetes, and starvation requires no special description, as it presents no special characteristics.

The true *tubercular ulceration* of the rectum may be a primary process, but in the majority of instances it is a secondary manifestation of pulmonary consumption. These ulcers are caused by the disintegration of small tuberculous nodules deposited in the mucous and the submucous coats of the bowel. They are sometimes scattered and sometimes closely packed together. Such ulcers are usually of considerable size and are found in the rectal ampulla or at the anus. They are irregular in outline, more or less ovoid, with their long axis parallel to the vertical axis of the bowel and corresponding to the direction in which the vessels in this locality run. They have a peculiar appearance, somewhat difficult to describe. They do not secrete pus, but a thin watery discharge, and are usually surrounded by a mucoid material.

Under the name of *lupoid ulceration* Ball describes the so-called rodent ulcer as one in which the essential element is a chronic intractable form of ulceration in the neighborhood of the anus and genital organs. Cripps states that this

disease is seldom met with in the rectum, and that few instances of its recurrence are on record. S. G. Gant has called attention to the fact that this variety of ulcer is frequently confused with cancer of the rectum and with tubercular ulceration, owing to the severe pain experienced, the amount of tissue destroyed, and its tendency to break out again and again, as well as its liability to increase in extent in spite of all treatment. Young and old persons are alike subject to it. The same authority states that this ulceration is not always rapid in its course, some patients living for years, while the disease slowly spreads and death finally ensues as the result of hæmorrhage or from a diarrhoea and its attending state of exhaustion. It is a superficial form of ulceration, and the character of the discharge is principally serous, containing but little pus.

The *chancreoid* form of ulcer of the rectum is rarely seen in this country. I have seen but one such case. Messrs. Andrews state that in the hospital of Saint-Lazare, in Paris, they were shown numerous cases of chancreoid of the rectum and the anus, caused by the practice of sodomy. These authors have also met with a few instances of this disease in cases of retrovaginal fistula in which the virus entered the rectum through the fistulous opening.

Regarding the *syphilitic* forms of ulceration of the rectum, it may be said that, in this country, at least, the only common manifestation is the mucous patch. It is my belief that the mucous patch exists more frequently within the rectum than is generally believed. In the late stages of syphilis a form of ulceration occurs in the rectum which often assumes extensive proportions and results in the formation of stricture of the bowel.

Treatment.—In dealing with all cases of rectal ulceration rest is of primary importance, for the healing process will not take place if the patient be permitted to follow the usual habits of life. The medicinal treatment must be adapted to the nature of the lesion as well as to the relief of any general disturbance. In cases of simple ulceration the use of an enema of flaxseed-tea is of advantage in cleansing the bowel and to procure an evacuation. A pint or more may be used once or twice a day. An astringent injection may be employed, such as fluid extract of hydrastis, 1 to 2 tablespoonfuls to 6 or 8 ounces of water; a solution of nitrate of silver, 2 to 8 grains to the ounce. Insufflation of various powders may be used with benefit, such as iodoform, subiodide or subgallate of bismuth; calomel and the subnitrate of bismuth, equal parts, etc. In this condition I have found the following injection valuable:—

R Fluid hydrastis, 2 drachms.
 Fluid extract of ergot, 2 drachms.
 Compound tincture of benzoin, 2 drachms.
 Fluid extract of hamamelis, 2 ounces.

M. Sig.: To be well shaken before using. One-half ounce at a time, to be injected into the rectum every day.

Pain can be allayed by the use of iodoform suppositories, 5 to 10 grains each, used every six to twelve hours. Opiates are injurious and sometimes dangerous.

No plan of treatment with which I am familiar will do much toward permanently curing the tubercular ulceration. Curettage and the application of iodoform have been used with temporary success only. Similar results are given by most writers.

In syphilitic ulceration of the rectum

we must depend upon mercury and the iodide of potassium. Antiseptic treatment of the local condition must be regularly and frequently carried out upon general principles observed in ulcerative processes elsewhere.

The most common cause of rectal stricture is septic ulceration, and the next most common is probably protracted labor. Syphilis and dysentery, thought by some to be very common as a cause, are responsible for comparatively few cases. The following operation is recommended: a preliminary colotomy is first performed so as to enable the surgeon to wash the bowel and in this way protect any ulceration present above the stricture so that it may have a chance to heal by avoiding contact with faecal matter. After dilating the sphincters, a circular incision is made around the muco-cutaneous margin, separating the gut from the sphincters and freeing it upwardly by dissection. Slight traction is made until healthier gut appears at the anal opening, and the loosened portion of the rectum may be excised. Two cases in which this operation brought about perfect recoveries. F. C. Wallis (Brit. Med. Jour., Oct. 6, 1900).

The body should be protected from undue exposure to cold and the diet should be carefully regulated. Stale bread, meat, milk, eggs, etc., may be used, but vegetables, as a rule, are to be avoided.

Congenital Malformations of the Rectum and the Anus.

The proportion of infants born with malformations of the lower portion of the intestinal tract is comparatively small. Harrison Cripps states that 1 case occurs in about every 4588 births. So far as published reports show, males form the larger percentage of cases.

Malformations of the rectum and anus result from arrested development of the so-called gut-tract during the early stages of foetal life.

The most practical classification for

the use of the general practitioner is that of J. M. Mathews:—

Congenital malformations of the anus: (1) narrowing or partial occlusion, (2) total occlusion, and (3) complete absence.

Malformations of the rectum: (1) partial occlusion, (2) complete obliteration, (3) unnatural termination, (4) complete absence of the rectum, and (5) communication with the vagina.

The symptoms are self-evident in cases of malformations of either the rectum or the anus. In all the varieties—except that of the partial occlusion of the anus and in those somewhat rare cases in which the bowel opens into the vagina, urethra, or bladder, or in some abnormal, but external, surface of the body—there will be signs of total obstruction of the bowels, such as distension of the abdomen and possibly faecal vomiting. (See also TUMORS OF THE RECTUM AND ANUS.)

LEWIS H. ADLER,
Philadelphia.

RELAPSING FEVER. See SPECIFIC INFECTIOUS FEVERS.

RENAL SURGICAL DISEASES. See URINARY SYSTEM.

RESORCIN.—Resorcin (resorcinum, U. S. P.; meta-di-oxy-benzene) is a diatomic phenol obtained from benzene-meta-di-sulphonic acid by sodium hydrate with heat. It is also produced from different resins and from umbelliferous gum-resins on fusion with caustic potash. It is isomeric with pyrocatechin hydroquinone. It occurs in small, colorless, rhombic prisms, or plates, which turn reddish on exposure; is neutral in reaction; has a sweetish, unpleasant taste, and a peculiar, but faint, odor, which resembles that of carbolic acid.

Preparations and Dose.—It is soluble in alcohol (1 in 0.5), in water (1 in 0.6), in ether, and in glycerin, but very slightly soluble in chloroform or in carbon disulphide. The best vehicles for medicinal purposes are alcohol, glycerin, and syrup of orange. Resorcin has antipyretic, antiseptic, antispasmodic, anticoncretic, analgesic, hæmostatic, and antizymotic properties. It is given in doses of from 2 to 30 grains, several times a day. Maximum single dose is 45 grains; maximum daily dose is 150 grains.

Poisoning by Resorcin.—In large doses (60 grains) resorcin causes a lowering of the temperature (which persists for two or three hours), nausea, oppression, languor, salivation, and profuse sweating. In larger doses it is followed by cerebral symptoms, such as giddiness, tingling, deafness, confused vision, tremor, clonic convulsions, and unconsciousness; the tongue is dry, the teeth clenched, the pupils normal, the temperature low, and the urine black (hæmoglobinuria). Death occurs from respiratory and cardiac paralysis. Death has occurred in children from lavage of the stomach with a 3-per-cent. solution. Schwabe recently reported a case in a child in which 15 grains in an enema produced alarming symptoms. In the adult recovery has followed the ingestion of 2 drachms.

Treatment of Poisoning by Resorcin.—Evacuation and lavage of the stomach are indicated. The administration of albumin, diffusible stimulants, and diuretics may be supplemented by the application of external warmth to the trunk and extremities. The use of atropine, strychnine, or ether hypodermically and of amyl-nitrite by inhalation or internally will counteract the paralyzing effect of resorcin upon the heart and the respiration. Red wine has been suggested as being useful in these cases.

Therapeutics. — **GASTRO - INTESTINAL DISORDERS.** — Resorcin has been employed in doses of from 1 to 2 1/2 grains, in solution or powder, repeated every hour or two, for the relief of vomiting and seasickness. In similar doses it has been found of value in dyspepsia, chronic gastric catarrh, diarrhœa, cholera nostras, cholera morbus, and in enteritis. It is also serviceable in the diarrhœa of children (enterocolitis or cholera infantum). It relieves pain and checks hæmorrhage from gastric ulcers. Gastralgia is relieved by this remedy. W. H. Thomson, of New York, suggests the following formula for this class of cases: Resorcin, 2 drachms; tincture of orange-peel, glycerin, and syrup of ginger, of each, 1/2 ounce; peppermint-water, sufficient to make 6 ounces. Of this a dessertspoonful in a wineglassful of water is taken after meals. If preferred, 2 to 4 grains may be given in pill or capsules before each meal, in cases of gastric ulcer, as suggested by Hare, who attributes the beneficial action to the analgesic, antiseptic, and hæmostatic powers of resorcin.

LEUCOPLAKIA.—In leucoplakia Leistikow advises: Resorcin, 6 parts; siliceous earth, 3 parts; lard, 1 part; this to be spread over the patches several times daily, especially after eating and before going to bed. After eight to fourteen days the opaline patches shrink and the mucous membrane becomes thin, rosy, and very sensitive. The mouth may be rinsed frequently with peppermint-water to which borax has been added. To overcome the hyperæmia caused by the resorcin, applications of balsam of Peru are useful.

FEVERS.—Resorcin in doses of from 30 to 60 grains has been used as an antipyretic, but it is not serviceable, as, in addition to the untoward symptoms produced by these large doses, it has little

power in strong fevers. It has been used, however, locally and internally in erysipelas, puerperal fever, and septicæmia with marked benefit.

RESPIRATORY DISORDERS. — Resorcin has been used in pertussis and hay fever, in the form of a spray from a 2-per-cent. solution and internally in doses of 10 drops of the same solution. Moncorvo, who introduced this method of treatment for whooping-cough, applies the solution, by means of a wire-handled throat-brush, to the perilaryngeal mucous membrane, every two or three hours during the day. In hay fever the spray-solution has been made as strong as 20 per cent. In a 2-per-cent. solution, it is a beneficial application to tuberculous lesions of the larynx, and in purulent and ulcerative affections of the throat and nose; in the nose the solution should not be stronger than 1 per cent. In diphtheria resorcin is a valuable topical remedy. In asthma and emphysema resorcin has been given in doses of from 5 to 15 grains.

CUTANEOUS DISORDERS. — Resorcin has been used topically in skin affections of a subacute or chronic character, in solution or ointment varying in strength from 1 to 10 per cent. or more. It should be borne in mind that weak solutions (1 to 3 per cent.) harden the skin, while stronger ones (10 to 50 per cent.) macerate and destroy it.

Following methods of using resorcin in alopecia recommended:—

R Resorcin, 1½ grains.

Quinine hydrochlorate, 3 grains.

Pure vaselin, 1 ounce.

This is to be applied to that part of the scalp which is devoid of hair, or from which the hair is rapidly falling. Should this preparation produce much irritation of the scalp, an ointment composed of 20 grains of borax to 100 of vaselin should be applied. Brocq (*Practitioner*; *Phila. Med. Jour.*, Apr. 22, '99).

Resorcin has been used with good effect in eczema with much induration and in psoriasis, for both of which the following formula may be used: Resorcin, oxide of zinc, of each, 1 drachm; rose-water ointment, 10 drachms. After mixing the ointment, heat it until the resorcin crystals melt, to prevent irritation of the skin; to be applied locally twice daily.

In erythematous eczema resorcin in weak solution may be used to allay the itching; a solution of 10 or 15 grains to the ounce of water, a little salt being added to aid in its absorption by the skin, should be dabbed, not rubbed, on the parts, or the following may be used: Resorcin, 15 grains; glycerin, 10 minims; lime-water, 1 ounce; mix and use as the preceding (Hare).

In the abortive treatment of herpes Leloir employs the following solutions: Resorcin, 30 grains; hydrochlorate of cocaine, 8 to 30 grains; tannic acid, 90 grains; alcohol (90 per cent.), 3 ounces; mix and apply locally. Or: Resorcin, 30 grains; hydrochlorate of cocaine, 15 grains; extract of cannabis Indica, 2½ drachms; spirit of peppermint, 2½ drachms; alcohol (90 per cent.), 2 ounces. Mix.

In acne rosacea, Petrini obtained good results from the application of the following, after the pustules had been opened: Resorcin, 15 grains; ichthyol, 30 grains; flexile collodion, 1 ounce. Mix.

In ringworm of the scalp and other parasitic disorders Julius Andeer used resorcin-soap (5 to 10 per cent.).

In the desquamative stage of scarlatina Jamieson used a resorcin-salicylic superfatted soap. In a series of cases washing the skin with this soap and warm water shortened the period of desquamation by two weeks.

For seborrhœic eczema Eddowes rec-

ommends: Resorcin, $\frac{1}{2}$ to 1 drachm; glycerin, 10 to 20 minims; vinegar of cantharides, 3 drachms; sweet-almond oil, 4 drachms; cologne spirits, 1 ounce; alcohol, 3 to 5 ounces; water, sufficient to make 8 ounces. This mixture forms a pleasant local application and relieves the itching.

The beneficial influence of resorcin is most markedly apparent in eczemas, especially eczema seborrhœicum; when resorcin is combined with alcohol, in the proportion of 2 drachms to 4 fluidounces, respectively, and applied thoroughly to the scalp by means of a dropper, the cure of this troublesome scalp affection will be thorough and satisfactory. C. H. Powell (Merck's Archives, Nov., '99).

In the treatment of extensive patches of tinea versicolor E. Bodin employs the following ointment: Resorcin and salicylic acid, of each, 15 grains; precipitated sulphur, 75 grains; lanolin, vaselin, and suet, of each, 6 drachms. Make up into an ointment.

In slowly-spreading epithelioma of the face Hartzell recommends the following plaster: Resorcin, 72 grains; yellow wax and powdered resin, $1\frac{1}{2}$ drachms; olive-oil, a sufficient quantity to make a plaster. Mario Luciani reports 2 cases of this disease cured by the following: Resorcin, $2\frac{1}{2}$ drachms; petrolatum, 1 ounce. To be applied once a day to the ulcerated surface after previously cleansing with a 2-per-cent. solution of borax.

Resorcin recommended in rodent ulcers, and also in the treatment of raw surfaces left after the removal of epithelioma. Case of epithelioma treated in this manner with success. Blomfield (Brit. Med. Jour., June 2, 1900).

In chilblains C. Boeck advises the use of the following: Resorcin, ichthyol, and tannin, of each, 30 parts; water, 150 parts; this is to be shaken well and applied to the unbroken skin every night; it cannot be used when the skin is broken or the surface ulcerated.

The following solution will not blacken the hands: Resorcin, 60 parts; gum arabic, 38 parts; water, 115 parts; talc, 15 parts; apply every night; less efficacious than the preceding one, but may be employed if the patient's work is such that he cannot use a substance which blackens his hands.

In chancroids, painful ulcers, and suppurating and sloughing wounds resorcin may be used externally in solution or ointment (1 to 10 per cent.) in injection or spray. Absorbent cotton and gauze may be medicated with resorcin for surgical dressings.

CATARRHAL DISORDERS.—Resorcin in a 1- to 2-per-cent. solution is used in spray for various catarrhal disorders. In acute and chronic conjunctivitis and wounds of the cornea resorcin solution (1- to 2-per-cent.) is of service. This solution may be used as an injection in urethritis, cystitis, vaginitis, and purulent otitis. In powder combined with boric acid (5 to 10 per cent.), it is very efficient in the treatment of discharges from the ear; the ear should be thoroughly cleansed with a solution of boric or carbolic acid, and dried, and the powder insufflated into the canal.

In aphthæ, stomatitis, and thrush, a 1- or 2-per-cent. watery solution of resorcin is an efficient application.

Derivatives and Allied Compounds.—**RESORCIN-EUCALYPTOL.**—This substance occurs as a white, crystalline powder, which is soluble in alcohol and has antiseptic properties. It is used externally as a dressing for wounds, ulcers, and skin diseases, in ointment or alcoholic solution.

RESORCIN-SALOL.—This is a combination of resorcin and phenyl-salicylate possessing antiseptic properties. It is used in the treatment of intestinal inflammations, diarrhœa, dysentery, ty-

phoid fever, rheumatism, etc. The dose is from 3 to 9 grains.

RESORCINOL.—This is not simple resorcin, which is also called by this name, but is obtained by melting equal parts of resorcin and iodoform. It occurs as an amorphous, brown powder having the odor of iodine and the taste of iodoform. It is an antiseptic and parasiticide, and is used externally as a surgical dressing for wounds, chancroids, ulcers, etc., and for the treatment of scabies, psoriasis, eczema, erysipelas, and other skin diseases. It is applied as a dusting-powder (20 to 50 per cent.) with starch or in ointment (7 to 15 per cent.) with lard.

RESORCIN-PHTHALEIN (FLUORESCIN, OR DIRESORCIN-PHTHALEIN).—This substance is obtained from phthalic anhydride by heat with resorcin to viscosity. It occurs as an orange-red, crystalline powder, soluble in ether, alkaline solutions, dilute acids, boiling alcohol, etc. It is used for the diagnosis of corneal lesions, and impervious strictures of the nasal duct, in solution of 10 grains to the ounce of water, 15 grains of bicarbonate of soda being added to perfect the solution. When this aqueous solution is dropped upon the cornea, those parts, however small, which are deprived of their epithelium are colored green, while foreign bodies are surrounded by a green ring (Straub). The solution is red by transmitted light, by reflected light it exhibits a beautiful green fluorescence.

RESORCIN-PHTHALIN, or fluorescin, is obtained from fluorescein by heating with sodium hydrate and zinc-dust. It occurs as a bright-yellow powder, which readily oxidizes into fluorescein.

RESOPYRIN is a reaction-product from mixing aqueous solutions of resorcin and antipyrine in molecular proportions. It occurs as a white, opaque mass, or as a

white powder, soluble in alcohol, ether, and chloroform. It is antipyretic, analgesic, and antiseptic. It is used in all febrile and painful conditions where antipyrine and resorcin are indicated. The dose is from 5 to 10 grains.

QUINOLINE-RESORCIN occurs as a gray, crystalline powder. It is antiseptic and antipyretic in its action. Clinical data are wanting.

THIO-RESORCIN is a reaction-product from heating resorcin with sulphur. It occurs as a yellowish-gray, tasteless, non-irritating powder, possessed of a penetrating odor (Merck), insoluble in water, and but sparingly soluble in alcohol and in ether. It is used as an iodoform substitute in leg-ulcers, as a dusting-powder, or in a 5-per-cent. ointment (Guttman); its application appears to be followed, sometimes, by unpleasant symptoms (Amon), though these may be traceable to admixture of resorcin.

HYDROQUINONE (hydrochinone, quinol, or para-di-oxy-benzene) is obtained from aniline by oxidation with chromic acid, mixture, and reduction of the quinone formed by sulphurous acid. It is also a product of the splitting-up of arbutin by hydrolysis. It occurs in long, colorless, dimorphous, sweet crystals (sometimes grayish white in color—Merck), which are soluble in alcohol, in ether, and in 17 parts of water. It is an antiseptic and antipyretic. It has been used externally in solution (1 to 3 per cent.) for conjunctivitis, gonorrhœa, etc., and for the treatment of infectious fevers, rheumatism, etc., in doses of from 5 to 15 grains. Maximum single dose is 30 grains.

PYROCATECHIN (pyrocatechuic acid, catechol, or ortho-di-oxy-benzene) is isomeric with resorcin and hydroquinone. It exists in nature, but is usually prepared from guaiacol. It occurs in color-

less scales or needles, soluble in water, alcohol, ether, chloroform, benzene (benzol), and hot toluol. Its aqueous solution reduces silver salts in the cold and Fehling's solution on warming; if the solutions are made alkaline they absorb oxygen rapidly and change to green and finally to black. It has antiseptic and antipyretic properties. It has been used as an antipyretic, but has bad after-effects (Brieger, Masing). It is used externally in solutions and ointment as a dressing for wounds, burns, injuries, etc. It is more powerfully antiseptic than carbolic acid, resorcin, or hydroquinone.

C. SUMNER WITHERSTINE,
Philadelphia.

RESPIRATORY ORGANS, NEUROSES OF.

Sensory Nasal Neuroses.—**ANOSMIA.**—Loss of the sense of smell is infrequently observed, though its impairment through any local disorder is quite frequent. Mechanical obstruction of the nasal cavities by growths, especially nasal polypi, prevents ascent of the odoriferous particles to the olfactory areas; inflammatory disorders of the nasal mucous membrane, acute or chronic, by causing infiltration of the tissues environing the olfactory fibrils, impair their sensitiveness and thus give rise to anosmia. Cerebral diseases of various kinds, cerebral tumors, locomotor ataxia, syphilis, lead poisoning, malaria, the excessive use of tobacco, the prolonged use of snuff, the prolonged inhalation of irritating fumes, etc., may be mentioned as among the many etiological factors of this disorder. The duration depends upon the cause; cases due to nasal growths usually recover their sense of smell soon after removal of the neoplasm, even though the latter may have been present a long time. Anosmia due to central disorders follows the course of the latter.

Treatment.—Measures calculated to remove the causative factor are obviously indicated. Cases due to syphilis often promptly yield to iodide of potassium. When strychnine can be used in gradually increasing doses it is often of benefit. Galvanism, the positive pole being covered with a moist cotton pledget and applied to the olfactory region, may be used simultaneously. The negative pole should be applied between the eyes and the electrode thoroughly moistened to insure penetration.

PAROSMIA, OR PAROSPHRESIS.—Disordered or perverted sense of smell, the patient complaining that foul, peculiar, or pleasant odors, putrid flesh, burning rags, urine, musk, etc., is a symptom occasionally observed in acute or chronic catarrhal disorders of the nasal cavities, syphilis of the nose, and of cerebral tumors when these directly or indirectly involve the olfactory bulb. It frequently accompanies various neuroses,—hysteria, epilepsy, insanity, neurasthenia, and locomotor ataxia especially,—and is sometimes observed during pregnancy, the menopause, and uterine disorders.

Treatment.—Here also the cause must be ascertained and removed. Mere cleansing of the nasal cavities twice a day with a lukewarm boric-acid solution (1 drachm to the pint of water) is often sufficient to cure the disorder when due to catarrhal congestion. Syphilitic parosmia quickly yields to specific treatment; but when it is due to cerebral tumors it follows the course of the latter.

HYPEROSMIA.—Abnormal sensitiveness of the sense of smell is rarely observed, and is usually associated with hysteria, neurasthenia, hypochondria, menopause, and other conditions in which the nervous system is in a state of temporary or permanent adynamia. It sometimes occurs as an excessive phys-

iological development, the sense of olfaction resembling that observed in some lower animals, especially dogs.

SPASMODIC SNEEZING.—This represents but a manifestation of a physiological function repeated frequently or continuing beyond the usual limits. It may be caused by an hyperæsthetic state of the pituitary membrane coupled with the presence of foreign particles capable, by their shape, of keeping up a titillation of the epithelial surfaces. It may be caused reflexly through the eyes, by sunshine, pregnancy, etc. I have witnessed two cases in which the menopause appeared to be the main etiological factor. The condition appears to me to be due to a temporary adynamia of the reflex centres. This is sustained by the fact that tonics and stimulants are usually beneficial.

Treatment.—To arrest a paroxysm, Koch recommends firm pressure upon the hard palate with the thumb, exerted before the close of the deep inspiration that precedes sneezing. In many cases, however, the palliative measures indicated below, under **HYPERÆSTHETIC RHINITIS**, must be resorted to. The application of chromic acid to the mucous membrane is an effective remedy when the condition has assumed chronicity. The acid may be applied melted by heat to the end of a flat probe, once a week, six or seven times.

Hyperæsthetic Rhinitis (Hay Fever; Rose Cold).

Symptoms.—The early symptoms of an attack of hay fever vary; in some cases there appear, one or two weeks before the access, a mild coryza, heaviness about the brow, general malaise, chilly sensations, itching at the roof of the mouth and eyes; but these manifestations do not always present themselves, the attack of hay fever beginning suddenly at pre-

cise dates,—August 10th for hay fever, May 10th for “rose cold,”—in the majority of cases. The disease occurs twice in the year in some individuals, but the great majority only suffer from one attack a year. “Rose cold” is somewhat shorter in duration than hay fever, which usually lasts about six weeks. Subjects of the disease can usually point to the exact day, and sometimes the hour of the expected attack.

The access usually begins with a sensation of itching in the nostrils, which soon becomes very intense, and causes violent and prolonged sneezing. A prickling, burning sensation in the inner canthi, followed by profuse lacrymation, may accompany this symptom, or constitute the first evidence of the attack. Very soon the nose becomes occluded through intumescence of its lining membrane, and respiration through it is practically impossible. A watery discharge appears, which soon becomes very profuse, and its strongly alkaline character causes it to irritate the nostrils and the upper lip, sufficiently sometimes to give rise to painful excoriations. Violent sneezing may begin at once, or occur when the watery discharge begins to trickle down along the intranasal walls, and the patient makes futile efforts, by immoderate use of the handkerchief, to clear the nose of the cause of obstruction and irritation. Chilly sensations, frontal headache, tinnitus aurium, loss of smell and taste, violent itching at the roof of the mouth, pain over the bridge of the nose, facial pruritus, and general symptoms, such as slight pyrexia, urticaria, disordered stomach, and flatulence, are among the possible accompaniments of this stage.

As the affection progresses, the nasal secretion assumes more of a mucoid character, becoming at times muco-purulent.

The conjunctiva may become greatly inflamed, and photophobia and marked chemosis follow, rendering, in some cases, a prolonged stay in a dark room necessary. Asthma may occur as a complication of the affection, or as its only symptom. It may present itself any time during the course of the disease; it manifests itself suddenly as soon as the irritating agent is inhaled. In the majority of cases, however, it begins a few days after the primary nasal symptoms have shown themselves, and as soon as these become marked.

Etiology and Pathology.—As at present interpreted, the morbid factors lying behind this disorder are: (a) an organic disorder of the nasal mucosa, (b) general nervous debility, and (c) an external irritant, the bloom of rag-weed, the pollen of flowers, dust, etc. In a certain proportion of cases cure of the nasal disorder, especially when nasal polypi, septal spurs, etc., are removed, prevents a return of hay fever; in others, removal to a country or district in which the irritating factor is not present also prevents the access. Two of the causative elements are thus demonstrable. The neurotic factor (abnormal excitability of the sympathetic system, according to John N. Mackenzie) may also be clearly traced in a large proportion of cases, while the family history often shows the presence of the disease in parents or near relatives. The periodicity of the disease is accounted for by the periodical appearance in the air of certain pollens. Thus, an individual whose nervous system is susceptible through general adynamia, and whose nasal mucous membrane is hyperæsthetic through a local lesion, develops an attack of hay fever or rose cold only when the pollen to which he may be susceptible is present in the air he breathes. This special susceptibility to

one or more substances—pollens, etc.—is comparable to that presented by many persons in respect to various drugs: belladonna, opium, etc.

[I do not regard hay fever in its active form as a disease *per se*, but merely as the symptom-complex of a sudden cessation of the inhibitory functions of the nerve-centres presiding over the physiological processes of the upper respiratory tract. These nerve-centres, under the influence of hereditary or acquired disease of an adynamic type, having themselves become adynamic, are able to carry on their functions under ordinary circumstances; but, when demand is imposed upon them for inordinate functional activity, they lose all power of control, and give rise to the symptoms observed after section of the sphenopalatine ganglion, or of the cervical sympathetic, as shown by Claude Bernard, most marked of which symptoms is hyperæsthesia. Hence the name "hyperæsthetic rhinitis," submitted by me some years ago in lieu of the absurd term "hay fever."

The main predisposing influences are, in my opinion, the diseases of childhood and disorders inherited or acquired, tending to induce adynamia: *i.e.*, a lowered, cellular activity, affecting mainly the nerve-centres alluded to. The *arthritisme* of the French, and the gouty or uric-acid diathesis (Bishop), being but results of deficient cellular activity, merely represent, from my stand-point, a single—though important—class of factors among the many that are capable of promoting the vulnerability of the nervous centres previously weakened through acquired or inherited adynamia. Hay fever would practically be a universal disease were an excess of uric acid in the blood its only or even its main cause. CHARLES E. DE M. SAJOURS.]

There can be no doubt that Dunbar has succeeded in extracting from the pollen of certain grasses (maize, wheat, rye, etc.) a toxin which, when instilled into the eyes or nostrils of people predisposed to hay fever, produces in these parts the characteristic subjective and objective symptoms of the disease. The

toxin, when injected into the eyes or nostrils of people not predisposed, produces, in the great majority of cases, no symptoms whatever. But it certainly appeared as if there were instances of transition in which, although the persons experimented upon never suffered from typical hay fever, they were yet more susceptible to the influence of the toxin than the ordinary run of people. The effects of the toxin in people suffering from hay fever are as variable in intensity as are the attacks of the affection itself, both with regard to the local and the constitutional symptoms. Dunbar's antitoxin certainly produced immediate disappearance of the subjective, and after a few minutes, great amelioration of the objective, symptoms. The mixture in equal parts of a toxic solution (1 in 500) and the antitoxic serum suffices to neutralize the specific effects of the toxin. The effects of the antitoxin appear in some instances to be sufficient to prevent a reappearance of the subjective symptoms, while in other instances repeated instillations of the antitoxin were required to produce ultimately the return to normal conditions. But all we know at the present is not sufficient to build the therapeutic hopes on, and this for the reason that we are ignorant of the nature of the special predisposition which exists in hay-fever subjects. Sir Felix Semon (*Brit. Med. Jour.*, March 28, 1903).

Hay fever is most frequently met with among brain-workers, professional men, clergymen, lawyers, merchants, etc. It may occur at any age, and seems to prevail with more frequency in men than women.

Treatment. — Careful examination of the nasal cavities and removal of any abnormal condition that may be present is of primary importance. Indeed, cases in which polypi, spurs, hypertrophies, etc., are found and removed often yield the most satisfactory results. Appropriate surgical treatment seems, in some cases, to relieve the hyperæsthesia of the

mucosa and, by eliminating one of the three causative factors, to arrest the disease. In some cases, repeated cauterization with glacial acetic acid of any unduly sensitive spot found in the intranasal tissues, especially the middle turbinated bone, by gently passing a probe over them, prevents the attack if the applications are made twice a week within the month preceding it. Galvanocautery and chromic acid tend to give rise to cicatricial induration and local dryness, if applied over broad areas, and therefore less valuable than glacial acetic acid.

The medicinal treatment indicated may be divided into two parts: that tending to counteract the nervous adynamia and that aiming to arrest the active symptoms. Strychnine in gradually increasing doses fulfills the first indication, atropine the second. I have found the following measures productive of excellent results when begun three months before the expected attack. The patient is given $\frac{1}{60}$ grain of strychnine during meals one week; after this, the dose is gradually increased until $\frac{1}{20}$ grain is taken three times a day. This dose should be reached by the second month and be continued throughout the latter and up to two weeks prior to the expected attack. The purpose of the strychnine is mainly to stimulate metabolism. The elimination of products of waste should then be encouraged by the administration of salicylate of sodium, 10 grains three times a day, large quantities of lithia-water being given simultaneously.

On the day the paroxysm is expected a granule of atropine, $\frac{1}{120}$ grain, is taken on rising and repeated in the evening if necessary. One granule daily is usually sufficient to prevent the attack if the nasal cavities are sprayed several times a day with a solution of menthol in albu-

lene, 5 grains to the ounce. Cocaine was at one time extensively used in these cases, but it is a pernicious drug, by causing secondary local paresis and subsequent aggravation of the symptoms. The measures for the asthmatic manifestations do not differ from those indicated in the classical form (see *ASTHMA*, vol. i).

Inhalations of the ordinary cologne-water produce marked sedative effect during paroxysms, a few whiffs being sufficient at times to arrest the intense pruritus. Mollière (*Lyon Méd.*, Jan. 21, '95).

The habits of the patient, both as to food and exercise, should be regulated with the greatest care. With restoration of the digestive tract, the general nutrition established upon a firm foundation, and the previously unstable nervous system steadied and invigorated, the patient is enabled to resist such disturbing influences as once proceeded from the contact of atmospheric irritants with the hyperæsthetic pituitary membrane. C. P. Grayson (*Ther. Gaz.*, Oct. 15, '97).

We have in the aqueous extract of suprarenal glands a powerful, local vasoconstrictor agent, and a contractor of erectile tissue, which it is safe to use in very considerable amounts without any dangerous or deleterious effects locally, or to the general constitution of the individual. In acute congestions it has its widest application and greatest opportunity for good, but in certain chronic conditions of the hay-fever type where redundant tissue seems prone to develop it can be relied upon as one of the most helpful adjuvants which we have at command. H. L. Swain (*Med. Record*, June 4, '98).

Hay fever successfully treated by suprarenal substance, all other measures being abandoned. Tabloids, representing 5 grains of suprarenal substance, were allowed to dissolve in the mouth every second, third, or fourth hour, according to the effects. If coryza or sneezing had begun, it would cease within fifteen minutes after taking a tabloid. The action of the suprarenal substance is to raise blood-pressure by increasing the

vascular tone, and this action may be local as well as general. To this effect in bringing about contraction of the vessels of the nasal mucous membrane relief experienced is attributed. S. Solis-Cohen (*Phila. Med. Jour.*, Aug. 13, '98).

In hay fever suprarenal extract is a most useful remedy. It will abort ordinary acute catarrh. Used internally it has a marked effect in lessening the symptoms of hay fever, and gives marked relief to the patient in twenty-four to forty-eight hours. When 5 grains are given every hour distinct local effects are soon noticed. In certain patients some vertigo is noticed, the heart becomes a little more rapid than usual, and there is some nervous excitement. There is but one possible inconvenience that can be foreseen. If the drug should be used constantly and persistently, the lessening of the blood-supply to the nasal tissues may lead to atrophy. The extract will abort asthmatic tendencies and will frequently arrest asthmatic attacks, although it will not affect asthma when the affection is fully developed. When, as is often the case, the asthma is due to congestion of the nasal passages, it will surely be benefited. Asthma on a gouty or rheumatic basis is also benefited. When the asthmatic attacks are associated with an atheromatous condition, or are caused by interstitial nephritis, no relief is given. The extract may be applied on pledgets of cotton or by the spray every two hours until relief comes. The application or spray may be repeated whenever the symptoms return. H. Beaman Douglas (*Med. News*, Mar. 24, 1900).

A 6-per-cent. solution may be sprayed into the nose every two hours until the symptoms are controlled. Internally, 5 grains of the saccharated extract are given every two hours until some giddiness or palpitation is observed, or until the vasomotor paralysis in the nose is brought under control. Then the dose should be diminished, though the remedy should be continued until the hay-fever season is safely passed. B. Douglas (*N. Y. Med. Jour.*, May 12, 1900).

Nitromuriatic acid in doses of 3 to 5 drops of the freshly prepared concentrated acid should be given after meals, and sometimes also at night, diluted with a half-tumblerful of water. After taking this the patient should rinse out his mouth and swallow another half-tumblerful of water. The hay-fever symptoms are usually relieved in forty-eight hours, but not a single dose must be omitted, or some symptoms will return. E. B. Gleason (*Inter. Med. Mag.*, Aug., 1900).

Snuffing of a 1-per-cent. solution of trichloroacetic acid as a cure for hay fever used in more than 30 cases with the very best results. Improvement and cure follow in two to eight days. H. Krause (*Therap. Monats.*, May, 1901).

Immunizing plan: *i.e.*, 2 to 10 drops of the tincture of fluid extract of ambrosia artemisiæ, in water, three times a day, during the two weeks preceding the time at which the paroxysm is expected; and, if need be, a nasal spray of suprarenal extract. Curtis (*Med. Record*, July 13, 1901).

Suprarenal extract gives favorable results when used locally, in simple vasomotor rhinitis without discoverable local abnormality or general dyscrasia. In some cases, in which there is some local abnormality in the nose, it only acts favorably after the abnormal condition has been remedied, and then may be found unnecessary; when rheumatism or other dyscrasia exists, it causes some reaction at first, but does not act as favorably as in uncomplicated cases. J. P. Clark (*Boston Med. and Surg. Jour.*, June 19, 1902).

Nasal Reflex Neuroses. — These are usually ascribed to an impulse starting from the termination of a nerve of nasal mucous membrane through the intermediary of a sympathetic centre and giving rise to morbid phenomena at a point more or less distant from the nose. Epilepsy, neuralgia, facial spasm, etc., have thus been traced to nasal disease. Whether the peripheral nerve-filaments, the nerve-trunk, their ganglia, or the

entire system is at fault is hardly determinable.

Reflex disturbances of the eyes are frequently observed as a result of hypertrophic rhinitis, atrophic rhinitis, polypi, etc. Cases of ciliary neurosis were cured by Seifert by division of nasal synechiæ. The connection between the nose and the eye mainly depends upon the nasal branch of the ophthalmic division of the fifth nerve. Cutaneous disorders are sometimes ascribable to nasal disorders, especially, according to Wells, the group known as the angioneuroses, including urticaria, herpes, pemphigus, erythema, etc.

Sensory Pharyngeal Neuroses.

ANÆSTHESIA occurs as a symptom of various disorders in which the general nutrition is impaired, especially anæmia and phthisis, and of cerebral disorders: apoplexy, general paralysis, tumors, etc. Some drugs—the bromides—induce sufficient anæsthesia of the pharynx to facilitate local operations in this region. Certain neuroses—epilepsy, hysteria, and chorea—are also attended by more or less pharyngeal anæsthesia.

HYPERÆSTHESIA. — Hyperæsthesia is usually observed in individuals whose pharynges are kept in a congested state through unhygienic habits, local disease, etc. Thus, drunkards almost invariably have very sensitive pharynges, while tonsillitis and pharyngitis, and certain gastric and hepatic disorders tend to cause hyperæsthesia through engorgement of the vascular system, etc. Pharyngitis sicca is frequently attended by marked hyperæsthesia.

PARÆSTHESIA.—Abnormal sensations in the pharynx, heat, cold, the presence of a foreign body, enlargement, "tickling," and particularly the painful sensation that a scratch produces are commonly observed. While occasionally

these subjective symptoms represent but hallucinations of sensation, a cause can usually be detected when a sufficiently careful search is instituted. A sensation suggesting the presence of a foreign body, for instance, is frequently due to an almost imperceptible laceration or abrasion of the mucous membrane caused by a spicule of bone, a small piece of crust, a seed, etc. Inflammatory tonsillar disorders of almost any kind may also act as etiological factors; the lingual tonsils or mass of lymphoid tissue at the base of the tongue when enlarged being especially active in this particular. Among the general diseases capable of acting as sources of this disorder are the menopause, the rheumatic and gouty diatheses, hysteria, and neurasthenia; among the local causes, elongation of the uvula, naso-pharyngeal catarrh, and pharyngitis sicca.

Treatment.—In all these manifestations the cause should be sought after and corrected and the pharyngeal surfaces treated according to the character of the lesion noted (see TONSILS AND PHARYNX).

Paralysis of the Pharynx.—**ETIOLOGY.**—Paralysis of the pharynx is usually caused by diphtheria, or syphilis, or cerebral affections implicating the nerves which supply the pharynx. It is sometimes caused by local inflammation, especially when this is membranous. The paralysis may be limited to one constrictor muscle, or involve them all; it is an occasional complication of hemiplegia. It frequently occurs as a precursor of death in febrile diseases, especially typhus and pneumonia.

SYMPTOMS.—Besides nasal speech, there is difficulty of deglutition, great effort being required to force the food down the œsophagus. Liquids are generally swallowed with less difficulty, but

their frequent passage into the larynx, especially when the epiglottis is also paralyzed, renders their use dangerous. When the soft palate is involved, the food may be forced into the posterior nasal cavity, through the efforts of the tongue to assist deglutition. The accumulation of mucus on the pharyngeal wall is very troublesome.

TREATMENT.—Besides treatment of the central cause, strychnine hypodermically and general tonics are almost always indicated. Arsenic is especially valuable when the affection is a sequel to diphtheria. Electricity serves the double purpose of assisting in the diagnosis and restoring motion. When the paralysis is of central origin, an interrupted current will cause contraction of the muscles, but this contraction will not occur if atrophy of the muscles is the principal pathological element of the case; the cure will then be rendered much more difficult, if at all possible. Therapeutically, electricity should be applied with both electrodes over the muscles for about ten minutes every other day.

Laryngismus Stridulus, or Spasmodic Laryngitis.—This is an affection of poorly-nourished or weak children in which dyspnoea, caused by spasmodic closure of the laryngeal aperture, suddenly occurs.

SYMPTOMS.—The attacks usually come on at night while the child is asleep. Awaking suddenly, the patient gasps for breath and shows every evidence of prompt suffocation without cough or hoarseness. The pulse becomes weak, cold sweats and cyanosis soon come on, and in a few moments the child may be at death's door. Often, however, after a few gasps, a quantity of air is suddenly drawn into the lungs with a "crowing" sound, the respiration becomes more normal, and in a few minutes the child seems

out of danger. This improvement is sometimes ephemeral, however, and the attack may return after a few minutes or hours, and continue several succeeding days and nights. The number of deaths, in a series of one hundred and sixty-four cases collected by Loos (*Archiv f. Kinderh.*, B. 21, H. 5 and 6) amounted to fourteen.

Four cases of an hitherto-undescribed form of laryngitis stridula characterized by inspiratory dyspnoea protracted for several weeks, but there were no paroxysmal attacks such as are the principal feature of the ordinary form. J. Comby (*Archives de Méd. des Enfants*, Jan., '98).

ETIOLOGY.—There being no inflammation of the larynx, the term "laryngitis" is not applicable, a spasmodic or nervous element alone prevailing, which, according to Escherich, is closely allied to tetany. It occurs about equally in children of both sexes, and may be caused by a nervous shock or excitement such as occurs when children are severely punished or even scolded. It occurs mainly in children who have soft bones and cartilages, flabby muscles, and general weakness; hence rachitis is considered as the main pathogenic factor in the vast majority of cases. The pressure of enlarged bronchial glands upon the vagus, adenoid vegetations, and hypertrophied tonsils seem to bear a close association with the disease. Gastro-intestinal disorders and exposure to cold and damp also represent common causes of this disorder.

In 144 cases of laryngismus stridulus 79 were boys and 65 were girls. In 55 the disease appeared at the age of from 1 to 6 months, in 55 from 6 to 12 months, and in 34 after the first year. Stage (*Bibl. for Laeger*, p. 251, '94).

In 100 cases of laryngismus stridulus—52 girls and 48 boys—94 showed positive signs of rachitis, 3 were free from this disease, and in 3 the diagnosis was uncertain. Sixty-two were between the

ages of 6 and 18 months when the disease developed. Bull (*Archiv f. Kinderh.*, B. 18, H. 1 and 2, '94).

Case in which laryngismus stridulus followed a bullet wound in the arm. J. W. Irwin (*Med. and Surg. Reporter*, Jan. 27, '94).

Two cases of laryngismus stridulus in which the spasm was due to the reflex irritation or impacted feces in the colon. M. Zancudo (*Med. Press and Circ.*, May 30, '94).

TREATMENT.—Measures calculated to meet the danger of suffocation, leaving the determination of its true nature until all immediate danger has been eliminated, are first indicated. A warm mustard foot-bath or a general bath usually serves its purpose very rapidly; sometimes cloths wrung out of cold water placed over the thyroid are sufficient. Of value is the production of emesis, either by titillating the back of the mouth with a feather or administering ipecac. The triturate tablets of the latter drug are recommended by Northrup, four or five of the $\frac{1}{100}$ -grain tablets being given every ten to thirty minutes until four or five have been taken, are specially valuable for this purpose. A few whiffs of chloroform or ether sometimes act favorably at once. The possibility of impaction of the epiglottis is to be remembered as a causative element, and, should it be found free, no harm will follow the introduction of the finger, which, in case of impaction, would have raised it without difficulty. The application of a sinapism to the liver tends to prevent recurrence of the attacks. The bromides, chloral, opium, belladonna, etc., also act advantageously. Morphine injections sometimes cut the attack short in a few moments.

When all means fail to re-establish normal respiration and the dyspnoea continues marked, intubation should be practiced. If instruments be not at

hand to perform the operation, the trachea must be opened or a catheter introduced into the larynx to temporize until intubation instruments can be obtained.

Motor Laryngeal Neuroses.

Adductor and Tensor Paralysis.—The main varieties of adductor paralysis—*i.e.*, paralysis of the muscles which close the glottis—are: paralysis of the adductors or lateral cricoarytenoids; paralysis of the internal tensors of the vocal cords or internal thyroarytenoid muscles, and paralysis of the interarytenoid muscle.

PARALYSIS OF THE LATERAL CRICOARYTENOID MUSCLES.—This variety of paralysis is that generally termed “hysterical aphonia,” owing to its prevalence among the female sex and the association it so often presents with disorders peculiar to them, neurotic and uterine. It usually comes on suddenly, the aphonia being generally total, including even, sometimes, the power to whisper. Some cases are able to sing, however, and the voice may also appear during laughter, sneezing, coughing, etc.; indeed, in every act involving vocal resonance, except talking. The vocal cords upon laryngoscopic examination are wide apart and fail to approximate when the patient is told to sound her voice, the formation of sound-waves being impossible. The mucosa in true cases of hysterical aphonia is pale. It is usually due to a shock or fright; sometimes no external cause can be found. There is, as a rule, a history of previous attacks.

Treatment.—In true hysterical aphonia the voice may return as suddenly as it disappeared without treatment. But therapeutic measures are required in the majority of cases, since prolonged paresis of the muscles is liable to promote their atrophy. The cases should be carefully examined and any abnormal condition corrected. Strychnine is always indi-

cated. The voice can usually be brought back, by local applications of electricity, one pole, using Mackenzie’s electrode, being inserted behind the larynx and the other, the negative pole, externally over the thyroid cartilage. A weak current is sufficient—indeed, at times, no current at all—to cure a case, the psychical effect being the main factor.

PARALYSIS OF THE INTERNAL THYROARYTENOID MUSCLES.—This form of laryngeal paralysis is usually manifested by hoarseness or low-pitched huskiness. The paralyzed muscles being tensors of the vocal cords, their mobility, as far as adduction and abduction are concerned, is practically unimpaired. When, therefore, the patient is asked to phonate while the laryngoscopic mirror is in position, the cords usually come together in the normal way, but, tension failing to simultaneously occur, an elliptical space remains between the margins of the cords. The coarse vibrations induced give rise to the characteristic voice. Paralysis of the internal thyroarytenoids may accompany various neuroses, especially neurasthenia. Local disorders, of a congestive kind, or excessive use of the voice are comparatively frequent causes of this variety of paralysis, which is, however, usually associated with other local motor lesions.

Treatment.—Total rest of the voice, faradization, increasing doses of strychnine, and massage of the anterior cervical region represent the indications for these cases, which, as a rule, readily yield to appropriate treatment.

PARALYSIS OF THE INTERARYTENOID MUSCLE.—This muscle is seldom paralyzed alone. Its position from side to side in the posterior wall of the larynx enables it to cause approximation of the neighboring portion of the cords about one-fourth of their length. When, there-

fore, it is paralyzed, only the anterior three-fourths of the cords are adducted, the posterior fourth remaining abducted and open. In the mirror a triangular gap may be discerned. As a result, vocal resonance is almost entirely prevented and aphonia is usually complete, or a peculiar whistling tone is given to whatever voice may remain. It is usually caused by prolonged catarrhal inflammation involving the interarytenoid space, and hysteria.

Treatment.—The treatment does not differ from that of other forms of paralysis. Any catarrhal condition that may be present should, of course, receive careful attention.

Abductor Paralysis.

UNILATERAL PARALYSIS OF THE POSTERIOR CRICOARYTENOID MUSCLES.—The vocal cords being separated or abducted by the cricoarytenoid muscles, paralysis of one of the latter causes the corresponding cord to remain adducted, —i.e., in the middle line or slightly beyond,—while the other cord acts normally, during phonation. The irregular triangular space forming the glottic aperture is sufficient for normal breathing, however, in the majority of cases; dyspnoea, therefore, is infrequently complained of, except under great exertion. The voice is seldom impaired, the only alteration being a certain degree of coarseness, especially marked after continued use of the voice. Examined laryngoscopically, the cord on the affected side will be seen to remain in the fixed position mentioned during inspiration.

BILATERAL PARALYSIS OF THE POSTERIOR CRICOARYTENOID MUSCLES.—When both muscles are paralyzed, we have a dangerous form to contend with, inspiration being almost prevented by the permanently adducted cords. The dyspnoea is

especially marked during inspiration; the cords being pressed downward and closer together by the air-pressure above them, through the suction induced below by the expansion of the chest. A whistling sound is heard, as the air rushes through the small aperture left open through relaxation of the arytenoids. During expiration, the air forced up the trachea separates the cords, owing to the inclined plane of the infraglottic tissues. Though the voice is practically normal, the continuous dyspnoea to which these patients are subjected is very distressing, and their continuous efforts to inhale after a few words have been uttered and the whistling noise produced gives the condition a character which is not soon forgotten. Slight congestion of the tissues sometimes so increases the likelihood of asphyxia that intubation or tracheotomy is at once necessary.

ETIOLOGY AND PATHOLOGY OF ABDUCTOR PARALYSIS.—Paralysis of the abductors is frequently produced by pressure upon one or both vagi or their recurrent branches, by various growths of the neck and thorax, goitre, œsophageal cancer, etc. The left recurrent—curving, as it does, around the aorta—is particularly exposed to the pressure of aneurisms in this situation, causing unilateral paralysis. The motor nerves of the vagus being all derived from the spinal accessory, any growth of the brain involving the origin of the latter or the vagus itself may also give rise to abductor paralysis. Bulbar lesions, amyotrophic lateral sclerosis, and locomotor ataxia may be mentioned as among the neuroses most frequently complicated in this manner; while typhoid fever, syphilis, lead poisoning, etc., may also give rise to abductor paralysis through involvement of the nervous supply in the general toxæmia. Again, the situation of the

posterior, cricoarytenoids outside and behind the larynx proper causes them to be greatly exposed, not only to involvement in neighboring inflammatory processes, but also to the mechanical effects of foreign bodies, hot liquids, or corrosives that may be swallowed.

TREATMENT OF ABDUCTOR PARALYSIS.—The likelihood of cure corresponds with the degree of amenability to treatment of the original cause. Whether it be syphilis, tuberculosis, aneurism, a cerebral neoplasm, etc., local treatment is absolutely subservient to that of the primary affection, and the treatment of the latter is therefore the first indication.

Measures must be adopted to stimulate the laryngeal muscles to action. Faradization is the most effective agent at our disposal. The laryngeal electrode (Morell Mackenzie's) is used as follows: The electrode being connected with the negative pole of a faradic battery, its extremity is introduced into the larynx, while the positive pole is connected with an ordinary surface electrode which the patient presses over the larynx externally, or with a necklet electrode. The extremities of both electrodes should be covered with sponge or kid, to prevent stinging. To insure penetration of the current the electrode-tip should be thoroughly wetted before each operation. The manipulation of Mackenzie's electrode is like that of an ordinary laryngeal forceps, the mirror being employed to note and conduct the localization of the tip of the instrument. The nearer the paralyzed muscle the application, the better. The electrode being in position, the finger-rest on the top of the handle is depressed, and firm pressure is exerted on the neck by the other electrode. At first this manipulation is quite difficult to perform, gagging and retching preventing the introduction of the instrument.

After a few trials, however, the parts become more tolerant, and the application can be borne, in the majority of cases, without trouble. Cocaine anæsthesia may be used in difficult cases, at least the first few times. Each application of the current should last but a few seconds, and be repeated several times at short intervals. One sitting every day should be obtained if possible.

The current may also be applied by placing one pole on each side of the neck externally. This method is very inferior to that just described. Better than it is electrical massage, which is carried out by placing the positive pole, thoroughly wetted, on one side of the larynx, and the fingers of the opposite hand (that holding the negative pole and in contact with the sponge) on the other side. The fingers, having become the conductors, are moved up and down and pressed into the surface of the neck, in the manner practiced by *masseurs*. They must also be kept wet by occasional immersion in water.

Strychnine, nux vomica, and other nerve-tonics should be used, if possible, to assist the electrical stimulus. Strychnine is especially valuable, either by the mouth or hypodermically, beginning with $\frac{1}{60}$ grain at a dose, three times a day, and gradually increasing until $\frac{1}{20}$ grain is reached. This dose cannot be taken by all patients, however, and the physiological effects of the drug should therefore carefully be watched.

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RESPIRATORY PASSAGES, FOREIGN BODIES IN.

Foreign Bodies in the Nasal Cavities.

Foreign bodies of various kinds may be introduced into the nasal cavities, or concretions may form therein and give rise to the symptoms occasioned by

foreign bodies. Again, living organisms—flies or their ova, maggots, leeches, etc.—may enter the anterior nares and cause stenosis, accompanied by symptoms varying with the nature of the offending structure.

Symptoms.—The symptoms may be subdivided into three classes: (1) those attending the presence of inanimate foreign substances; (2) those caused by concretions formed in the nares: rhinoliths or nasal calculi; and (3) those due to the entrance of living structures: flies, their ova, etc.

Various substances—such as buttons, pebbles, coins, fruit-stones, beans, and other dense bodies—may at first give rise to no active manifestations. In the majority of instances there is more or less profuse sero-mucous exudation, followed, if the foreign body causes pressure, by a muco-purulent discharge. The fact that this is unilateral serves to differentiate it from a purely catarrhal disorder in children. The affected side of the nose sometimes projects more than the other. This may occur early, when organic bodies such as peas, beans, etc., are present. These may even germinate *in situ*. When a history of the penetration of a foreign body cannot be obtained, examination with the probe usually establishes the diagnosis. In adults the only conditions with which confusion could arise are malignant or semimalignant tumors, which are very rare; and syphilis and tuberculosis, diathetic diseases presenting other characteristic symptoms.

Concretions formed in the nares, also termed nasal calculi or rhinoliths, generally start with an inorganic body as a nucleus, but they may occur without these, through accretion of salts derived from the nasal mucus. Whichever way they originate, they steadily become

larger through deposition on their surfaces of these salts,—the phosphate of lime and magnesia, chloride of lime, carbonate of lime, etc.,—and may attain, though very gradually, sufficiently large size to completely occlude the narium affected. Besides the symptoms caused by inorganic bodies, there may be severe pain, due to pressure and repeated attacks of epistaxis. The diagnostic features do not differ from those of the form just described, but the probe can usually elicit by the “ring” or grating-sensation conveyed to the hand the character of the occluding substance.

When *living organisms*—flies, maggots, etc.—are present, all the symptoms enumerated occur, but they are supplemented by others that become very severe in advanced cases. If living insects that may have invaded the cavities fully grown, or have developed from ova, are present, they may feed upon the living tissues themselves, causing ulcerative processes. These may not only involve the mucous membrane and the underlying bone, but the inflammation may extend to the meninges and bring on a fatal issue. Severe pain radiating in various directions, formication; a nauseating, purulent, bloody discharge; frequent attacks of epistaxis, and swelling of the facial tissues are the most evident symptoms present.

Treatment.—Removal is obviously indicated, but this is not always easily accomplished, especially when the foreign body is imbedded in the tissues or surrounded by adventitious material, salts, etc. The local use of a 10-per-cent. solution of cocaine greatly facilitates examination with the probe, and under a good light the character of the trouble can usually be determined and the offending substance withdrawn. The flat end of a probe when curved flatwise is

efficient for this purpose when it is possible to pass the hooked end either beneath or over the foreign substance. Small polypus-forceps sometimes suffice. Loose bodies can often be ejected by the use of Politzer's bag in the opposite nostril or by means of sternutatories.

When solidly impacted, the foreign body may have to be crushed by means of a pair of solid forceps or drilled or sawed through. These operations are dangerous, however, unless performed by an expert rhinologist. The foreign body may sometimes be pushed back into the naso-pharynx and removed with the post-nasal forceps, but care must be taken not to lacerate the Eustachian promontory.

Foreign Bodies in the Pharynx.—This subject has been in part reviewed in the article on the *ŒSOPHAGUS* (volume v), the majority of foreign bodies which enter the pharynx being, in reality, impacted in the upper portion of the former, either behind the larynx or on either side of the latter, in one of the pyriform sinuses, or above the epiglottis. When, therefore, foreign bodies of the pharynx are spoken of and the limits of this cavity are properly established, the scope of the subject becomes restricted. Indeed, unless it be a sharp object capable of sufficiently lacerating the upright posterior pharyngeal wall to hold on to it, a foreign body will either pass below to the *œsophagus* as stated, or into the larynx, or lodge behind one of the pillars or into the tonsils. Strictly speaking, the latter are the seat of almost all foreign bodies which can be said to have become impacted in the pharynx. These are almost always sharp objects, fish-bones, tacks, pins, etc.,—capable of easily penetrating the tonsillar crypts or between the pil-

lars, or in the recess behind the posterior pillar.

Foreign bodies are often referred to as still present in the pharynx when, in reality, they have passed downward. This is usually due to the presence of a minute abrasion or scratch produced by the foreign body on its way downward. Again, hysterical subjects seem to present a predilection for pharyngeal foreign bodies, and in the majority of cases of this kind a foreign body has not been swallowed at all.

Foreign Bodies in the Larynx.—The foreign bodies that may become engaged in the larynx may be said to represent almost anything that may be introduced into the mouth. A large mass of meat totally beyond the dimensions of the cavity may dip one of its extremities into the latter, and cause fatal dyspnoea by acting as a stopper, or it may become jammed between the pharyngeal wall and the end of the epiglottis, and thus also cause immediate asphyxia. Tooth-plates, among the larger objects, are also frequent intruders in this region. Those which most frequently become lodged there, however, are principally articles of diet,—bones, bread-crusts, fish-bones, etc.,—which are drawn into the air-passages during a fit of laughter, just as the act of deglutition is being performed. Their penetration into the air-tract depends greatly upon their size, small objects being frequently drawn into the trachea, while large objects remain in the upper part of the cavity.

Symptoms.—Immediate and violent retching, or coughing if the passage is not entirely occluded, follows entrance into the larynx of any object: a reflex act calculated to dislodge it. Sometimes this succeeds, the foreign body is coughed up and out, and the patient recovers at once, although his throat may remain

painful for several days. When the foreign body is large enough to fill the laryngeal cavity sufficiently to occlude it, and the first expulsive effort does not succeed, the patient, having comparatively emptied his lungs of air, finds it impossible to inhale; he makes desperate efforts to draw air into his lungs, each effort causing the offending object to impact itself more tightly in the glottis. In the great majority of cases, however, the object is of such a shape and form that sufficient air is permitted to enter the lungs to keep the patient alive. In this case, the first paroxysm, although severe, subsides; violent paroxysms of coughing follow, and, after a few minutes, comparative comfort is enjoyed until another coughing spell brings on dyspnoea and a renewal of the first symptoms. After a time, the larynx seems to become accustomed to its new occupant, and a small object may even be forgotten and ejected in a fit of sneezing or coughing long after. In many cases, however, such is not the case, and organic lesions may be caused which may endanger the patient's life. The inflammation occasionally extends to the lungs, and a fatal result may be caused by pneumonia. Again, notwithstanding the spontaneous expulsion of a foreign body, secondary inflammation may follow and endanger the patient by oedema of the larynx. Under such circumstances, the patient at once experiences the preliminary stages of asphyxia; he gasps for breath and unless assistance be at once provided may die in a few moments. This is only apt to occur, however, when a mass totally occluding the larynx, such as a piece of dough or meat, becomes impacted.

Treatment.—The simplest means are sometimes sufficient to dislodge an impacted body. A violent slap on the back, just as an expulsive effort is being per-

formed by the patient, often succeeds. At times, the object remains over the aperture and can easily be removed with the finger. As we have seen under the heading of FOREIGN BODIES IN THE PHARYNX, the epiglottis may be held down by the impacted body so as to completely close the laryngeal aperture; the finger can also be used in this case.

When the foreign body presents a certain degree of weight, such as a piece of coin, a bullet, etc., an effort may be made to cause its fall from the larynx by inverting the body, the patient standing on his hands while his feet are held up; or he may be placed, face downward, on a table, one end of which is then raised as high as possible.

Pins and needles, tacks, and bones—*i.e.*, objects having a tendency to penetrate into the tissues when efforts at expulsion are made which cause them to increase their hold—can be withdrawn by means of forceps with the assistance of the laryngeal mirror. Before cocaine was introduced, this was an exceedingly difficult procedure. The larynx, through the pressure of the foreign body, became much more sensitive than usual, and the mirror could hardly be borne, let alone the forceps. In the midst of the retching and gagging, which occurred in most cases, the forceps had to be introduced, and advantage taken of an effort at inspiration to seize the object and draw it out. With cocaine, however, the operation is greatly simplified; a 10-per-cent. solution applied generously to the laryngeal membrane and all the parts around the larynx, including the epiglottis and the base of the tongue, so anæsthetizes the throat as to render the extraction of the foreign body a comparatively easy task. Any laryngeal forceps may be employed to grasp small objects, while

Fauvel's, Mackenzie's, or Cuzco's may be used for large ones.

When the foreign body cannot be reached and suffocation is threatened, tracheotomy is the only resort, and should be performed. If the necessary instruments are not at hand, the trachea may be opened with a penknife and the wound kept patulous with carefully cleansed hair-pins the curved ends of which are bent into hooks. The sharp ends being also bent into hooks in the opposite direction, thus forming an S, the pins are secured by means of a piece of tape passed around the patient's neck. Or the thyrocricoid membrane may be divided, thus furnishing a sufficient opening for the admission of air until more decided measures can be adopted. Before doing this, however, it is advisable to ascertain as nearly as possible the location of the foreign body, to avoid making an unnecessary opening in case it should have fallen into the trachea. The location of the foreign body may often be ascertained by auscultation, a whistling noise being audible at the point of impaction; a stethoscope may be used for the neck.

Tracheotomy is occasionally performed to enable a foreign body impacted in the trachea to be coughed out. The opening made in the windpipe should be longer than for the introduction of the cannula: one inch and a quarter for an adult and about one inch for a child. The spontaneous extrusion of the foreign body is thus greatly facilitated.

Cocaine can be used to great advantage for the mechanical removal of foreign bodies located in the trachea, and especially in either bronchi, through a tracheal opening. For the removal of an object located above the wound, thorough anæsthesia of the larynx from above, and also from below, by means of a small atomizer with a curved tip, using

a 10-per-cent. solution, permits the introduction of a small mirror into the trachea, through the wound, without provoking cough. A probe, curved upward, is then passed in, and the foreign body pushed up into and out of the larynx. The operation can thus be conducted in the safest possible manner, and be accomplished much more rapidly. A foreign body impacted in one of the bronchi can sometimes be seen by introducing the mirror with its face downward; the anæsthetic having been carefully applied, its exact location, shape, and surroundings can be ascertained, and a suitable forceps employed for its extraction.

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RETINA AND OPTIC NERVE, DISEASES OF. See OPTIC NERVE AND RETINA.

RHEUMATISM.—From Gr., *ρευμα*, fluid.

Definition.—A disease, probably of parasitic origin, characterized by pain, swelling of the joints and of the muscles, and which may be acute or chronic.

Acute rheumatism of the joints, or rheumatic fever, is a febrile, migratory, disease, liable to complicating inflammations of the pericardium and of other visceral serous membranes, and to recurrences.

Acute Rheumatism, or Rheumatic Fever.

Symptoms.—Rheumatic fever rarely presents marked prodromal symptoms, but ordinarily the patient feels weary and sick for from one to three days. The symptoms of the acute disease then set in suddenly with chills, which may be repeated once or twice; fever appears and the temperature rises to 39° or 40°

C. (102° to 104° F.); the pulse and respiration are accelerated, the tongue furred; there is no appetite, but thirst. The urine is scarce and loaded with urates, which give it a dark-red color and rapidly precipitate; the specific gravity of the urine is high, and it is not rare to observe albuminuria the first days of a rheumatic fever. Chemical examination demonstrates that urea as well as uric acid are present in excessive quantity. Hæmoglobinuria, peptonuria, urobilinuria, and cystinuria have sometimes been observed.

The skin is covered with abundant perspiration and numerous miliaria alba or rubra often appear on it. Simultaneously with the fever the characteristic signs of rheumatic arthritis appear, generally in the articulations of the foot or the knee. Frequently the affection begins in the articulation talo-cruralis, and after some days the process also invades the knees, the shoulder, the elbow-joint, and the hands.

Otitis media is often a prodrome of acute articular rheumatism. The bacteriologist in searching for the microbe of polyarthritis should examine the secretions taken from the drum-cavity immediately after paracentesis of the membrane has been performed in a case of acute rheumatic otitis media. O. Wolf (Arch. f. Ohrenh., Dec., '96).

The affection occasionally begins in the articulations of the arms. When this is the case it ordinarily occurs in persons occupied in hard, bodily work; the larger joints are most frequently affected, but also the small joints of the fingers and of the toes. A single joint rarely continues to be the seat of trouble for more than four or five days; the affection then suddenly disappears, commonly during the night, and one or more other articulations are attacked in turn. In very severe cases almost all articula-

tions may be affected simultaneously and even the joints of the jaws, the spine, and the ribs may be painful and swollen. Ordinarily rheumatic fever attacks several articulations, but monarticular acute rheumatism has also been observed.

According to statistics, the localization of the disease in the different joints is as follows: Foot, 27.8 per cent.; knee, 17.9 per cent.; hand, 9.6 per cent.; shoulder, 6.2 per cent.; hip, 4.1 per cent.; metatarsus, 3.7 per cent.; elbow, 2.2 per cent.; metacarpus, 1.2 per cent.; toes, 0.8 per cent.; fingers, 0.8 per cent.

The affected joints are very painful, swollen; the overlying skin is red, hot, tense, and œdematous, while pressure upon it leaves an impression which remains visible for some time. Swelling of the joint is principally caused by the œdema of the skin and of the ligaments, but occasionally also by an effusion in the articulation itself. By moving the diseased articulation a crackling sound is sometimes heard; this is commonly caused by the inflammatory changes of the tendons and their synovial membranes. Moving and even touching the affected joints is very painful to the patient; in severe cases the pain may be occasioned by very small commotions, such as is caused by walking over the floor of the sick-room. The pain seems to be localized in the tendons and the muscles in the proximity of the articulation, and, when it is possible to induce the patient to keep completely quiet, slight movements of the diseased joint may be passively executed without causing any pain, whereas the most trifling active movement is accompanied by excruciating pain.

The skin over the affected articulation shows increased sensibility to changes of temperature, but a diminished sensibility to faradic irritation.

The temperature of the patient is raised in proportion to the number of the affected articulations; in uncomplicated cases it seldom rises above 39° to 40° C. (102.2° to 104° F.), but it may also oscillate between 38° and 39° C. (100.4° to 102.2° F.).

Case of a woman, aged 30 years. On the twenty-first day of the disease the temperature rose to 107.8° F., the pulse being 174, weak, and irregular. This continued about twenty-four hours. Sponging with water at 48° F. reduced the temperature in that time, and thermometer subsequently did not register above 102° F. A soft mitral systolic murmur was thus detected. H. R. C. Newman (Lancet, June 16, 1900).

The duration of rheumatic fever varies from some days to several weeks or even months; it is liable to remissions and exacerbations, and especially when the patient leaves the bed or the sick-room too soon exacerbations are frequently observed. In some cases the fever declines, but one or more articulations remain swollen and painful for a long time; a critical decline of the temperature is rarely observed.

When the swelling of the articulations subsides the cuticle commonly cracks and peels off in small scales. As many red corpuscles of the blood perish during a severe attack of rheumatic fever, the patients get pale and weary, and the anæmia often continues for a long time after the recovery from the disease itself.

Series of eighty examinations in twenty cases of acute rheumatism. In every case of acute rheumatism examined there was a distinct increase of white corpuscles, although there was never any extreme degree of leucocytosis. The highest number observed was nearly 20,000 white corpuscles per cubic millimetre, the number in healthy blood being between 6000 and 7000. The rapid increase of white corpuscles commenced very early in the rheumatic attacks, and

declined equally rapidly in the convalescence, keeping closely parallel with the diminution and replacement of the red corpuscles, but apparently more influenced by the degree of febrile heat. Garrod (Brit. Med. Jour., May 28, '92).

Some authors have mentioned a larvated kind of acute rheumatism, characterized by neuralgia accompanied by high fever, as, for instance, of the trigeminus or ischiatic, but without involvement of the joints and yielding rapidly to the use of salicylates. During an epidemic of rheumatic fever sometimes endocarditis or pericarditis with high fever is observed in patients who do not suffer from any affection of the articulations; such cases have been denominated "polyarthritidis rheumatica sine arthritide."

A little-noticed symptom of acute rheumatism is a sharp pain in some nerve-trunk or region supplied by the arborizations of a single nerve. This affection of the nerve-trunk usually runs along parallel to the rheumatism, at times being but little noted, yet at others becoming more noticeable. It is evidently a sort of metastatic perineuritis set up by the same agents which have produced the rheumatism. F. Steiner (Deutsches Archiv f. klin. Med., 58, p. 237, '98).

Analysis of 450 cases of rheumatic fever treated at Charing Cross Hospital from 1890 to 1897. Sexes were equally divided. Seventy-two per cent. of the cases occurred between the ages of ten and thirty years. Heredity seemed to have been active in 22 per cent. The seasonal maximum was in May and November. The knee and ankle were nearly twice as often affected as any other joints. Endocarditis occurred in 28 per cent. of the males and 33 per cent. of females. Hyperpyrexia occurred in only 2 cases. W. C. Bosanquet (Lancet, June 2, 1900).

Complications.—These are very frequent and affect especially the heart and the nervous system. Endocarditis ver-

rucosa and even ulcerosa is observed in a large proportion of cases and especially when the fever is high and many joints are affected. Pericarditis is not quite so frequently observed; endocarditis occurs in about 20 per cent. of all cases, pericarditis in about 14 per cent., but these proportions vary, the epidemics of rheumatic fever differing very much in regard to severity and frequency of complications.

Dilatation of the heart ending in death may occasionally occur without valvular disease or general adhesion of the pericardium being present; in rare instances hypertrophy of the heart may occur without valvular disease or general adhesion of the pericardium. There is evidence that myocarditis may exist in the absence of pericarditis, and slight weakening of the myocardium may be shown by loss of physical energy, by attacks of cardiac pain, or by tachycardia. Theodore Fisher (*Lancet*, June 7, 1902).

In almost all cases some dilatation of the right heart is found and a febrile murmur is heard over the heart, but these signs are not necessarily due to endocarditis, and may be caused by the high fever. In consequence of the endocarditis the muscles of the heart may also be affected either by simple spreading through contiguity or by emboli. The symptoms and pathology of endocarditis and pericarditis are discussed elsewhere in this work.

In rheumatic heart disease of childhood the first indication of endocarditis is the presence of a systolic murmur at the apex, the second sound being still audible. Often this latter becomes doubled, after a time, the doubling being heard only in the apex-region, and being, therefore, different from the duplicated pulmonary sound of advanced mitral stenosis. The first element of the second sound always remains a sharp, short sound as long as it is audible at all. The second element may be substituted

by a short, blowing murmur, an early diastolic, or middiastolic murmur. At a later stage there may be at the apex a systolic murmur, followed by a longer and louder systolic. This presystolic murmur is blowing in character and usually short and is common in children after a rheumatic attack. It is usually accompanied by evidences of great dilatation of the heart. A presystolic murmur may end sharply with the systole, or it may be prolonged backward to occupy the greater part of the diastole. It has rarely the loud rough churning character of the presystolic murmur of marked mitral stenosis. Care should be taken not to consider a soft, double sound at the base an evidence of commencing aortic disease. It is often the first indication of pericarditis. D. B. Lees (*Brit. Med. Jour.*, Oct. 15, '98).

Very dangerous and rather frequent are the complications involving the brain. In some cases the symptoms are only caused by the hyperpyrexia; when the temperature rises to 41° or 42° C. (105.8° or 107.6° F.) or even to 43° C. (109.4° F.), when the perspiration is very profuse, and signs of endocarditis develop, there is imminent danger of cerebral rheumatism. When symptoms of meningitis occur, they are not necessarily due to veritable inflammation of the meninges, but may be caused by hæmorrhage, œdema, or hyperæmia.

Case of hyperpyrexia noted in sub-acute rheumatic fever in a man, aged 32 years, on the sixteenth day of his illness. Temperature when first taken was 106.4° F., and, notwithstanding antipyretic treatment, rose to 107.4° F. Temperature persisted around this point for a period of twelve hours, when it fell rather abruptly and the patient recovered. R. T. Ferguson (*Brit. Med. Jour.*, Jan. 21, '99).

A uræmic condition of the blood may also give cerebral symptoms. Cerebral rheumatism may manifest itself in different ways.

1. When it is *foudroyant* the patient is seized by sudden agitation; although previously unable to make a movement without extreme pain, he now leaves the bed and walks about, speaks and cries, and suddenly collapses and dies. The temperature ranges from 42° to 43° C. (107.6° to 109.4° F.) and often even gets higher after death.

2. An acute form of cerebral rheumatism is more frequently observed. There is likewise a high fever; the delirium commences more quietly, but after a little time the patient becomes agitated, and may have epileptic fits, these symptoms being followed by profound coma and commonly by death. Although ordinarily the cerebral symptoms are combined with very high temperature, they have, nevertheless, also been observed with a temperature not exceeding 39° C. (102.2° F.); the frequency of the pulse is proportionate to the fever and can reach 120 to 140 per minute. The ordinary duration of the acute form of cerebral rheumatism is two or three days; it may sometimes be of ten to twelve days, and rarely ends in recovery.

3. Subacute or chronic cerebral rheumatism appears in the later stages of the rheumatic fever and is ordinarily of a melancholic and stuporous character. The patients refuse to speak, even to eat, and are often harassed by hallucinations. They may remain in this condition for months, but the disease ordinarily ends in recovery.

Complications of the spinal cord have been described, but their existence has not been proved beyond doubt. The peripheral nerves may also be affected during rheumatic fever, but far more frequently are diseases of the nerves observed after some time as a consequence of the pathological changes caused by this affection. Chorea, polyneuritis, neu-

ralgia, and sciatica have been witnessed by trustworthy observers.

Case in which rheumatism was followed by practically complete atrophy of the deltoid and inability to raise the shoulder. By proper instruction, the man was rendered able to use the neighboring muscles. The exercises consisted in elevating the shoulder and adducting it to fix the humerus in the joint. Rothmann (*Deut. med. Woch.*, June 8, '99).

Acute rheumatism is an infective disease *sui generis*. There is a true rheumatic pharyngitis and tonsillitis. Rheumatic pharyngitis or tonsillitis is a primary infectious disease.

Rheumatic fever is a secondary infection, due either to the absorption of the products of the infective micro-organisms or to the growth of such micro-organisms in the tissues, and the infection may manifest itself in arthritis, pericarditis, endocarditis, chorea, bronchitis, pleurisy, alone or in association.

In a large percentage of cases the portal of infection is in the fauces or pharynx, or other region of the upper respiratory tract, but most frequently the oro-pharyngeal lymphoid ring. There is no proportion between the intensity of the primary local lesion and the appearance or severity of the secondary systemic complications. P. W. Williams (*Bristol Medico-Chirurgical Journal*, Sept., 1904).

During an epidemic of rheumatic fever Steiner observed thirty-five cases complicated with disease of the peripheral nerves characterized by increased sensibility to pressure and by spontaneous pain. In eight of these the swelling of the joints was not important, but there was tenderness. Steiner claims that the pain of the nerves was caused by perineuritis.

Complications involving the respiratory organs are not so frequently observed. Coryza, tracheo-bronchitis, and laryngitis may be seen during the prodromal stage; during the acute stage the lungs may be affected either by

œdema or, more rarely, by pneumonia, particularly of the migratory form. Rather frequently the pleuræ are involved. When the pericardium is affected the disease tends to spread to the left pleura, which consequently is more frequently attacked than the right. Rheumatic pleurisy is characterized by abundant fibrinous membranes, but scanty exudation of serous fluid; it develops very rapidly and furnishes the ordinary physical signs of pleurisy to a very marked degree. Its duration varies from three to eight days. Sometimes the right pleura is attacked while the pleurisy of the left side is undergoing resolution.

Tonsillitis is a very frequent complication of the prodromal stage; it is commonly believed that it is of etiological influence on the development of the rheumatic fever. Peritonitis is a very rare complication; in some cases bleeding from the bowels and from the uterus has been observed.

Albuminuria is almost constantly observed; acute nephritis and hæmaturia may occur. Anuria is a rare complication; it may be caused either by acute nephritis or by emboli from an endocarditis.

Cystitis, hydrocele, and orchitis have been mentioned by some authors as rare complications of acute articular rheumatism.

The cutaneous complications include roseola, urticaria, erythema multiforme, herpes facialis, and, more rarely, erysipelas, gangrene, purpura with ecchymotic spots, sometimes covered by blisters containing a serous, bloody, or purulent fluid. During the course of rheumatic fever small knots sometimes appear under the skin, especially on the front and on the back of the head; they dis-

appear with the other symptoms of the disease.

Seven cases of erythema multiforme and two of purpura rheumatica occurring during the course of acute rheumatism. One is justified in regarding erythema multiforme as, *par excellence*, a septic skin disease. From this conclusion and the relation between erythema multiforme and rheumatism, it follows that the latter is also to be regarded as, in a wide sense, a septic blood disease. Singer (Wiener klin. Woch., No. 38, '97).

Case of a boy, 15 years of age, suffering from mitral regurgitation, who developed an erythematous eruption on various parts of the body, involving also the mucous membranes. Both processes regarded as probably the result of a rheumatic intoxication. Case of a man suffering from exudative erythema, and at the same time swelling of the right wrist. The latter was apparently the result of an injury. Third case of the same disease in which there was associated hæmorrhagic eruption upon the legs and the signs of mitral regurgitation—a condition that somewhat resembled purpura rheumatica. Behrend (Münchener med. Wochen., July 9, 1901).

The muscles in the proximity of the affected joints are always painful and swollen; this may also be observed in muscles more distant from the diseased joints. In rare cases true inflammation and abscesses have been observed in the muscles. In the synovial sheaths of the tendons small knots have been observed especially in children; these knots consist of connective tissue and fibrocartilage, and may exist for some months, but tend to disappear spontaneously.

The affection of the joints themselves may be complicated by suppurative inflammation leading to opening of the articulation and to pyæmia, or ending in ankylosis.

Many of these complications may, in turn, give rise to such disorders as ankylosis, valvular disease, chronic nephritis,

and mental disease and chorea (in children).

Neither the eyeball nor its appendages are often affected by articular rheumatism. Iritis rarely occurs with it, but cases of conjunctival congestion without muco-purulent discharge have been noticed. One is compelled, however, to recognize the use of the term "rheumatism" as applied to an extensive group of symptoms which are probably dependent on the same causes with articular rheumatism. Sudden exposure to cold and overmuscular exertion are the principal exciting causes. Some of the diseases of the eye ascribed to the chronic type of rheumatism are iritis, episcleritis, scleritis, keratitis, orbital cellulitis, optic neuritis, choroiditis, ocular palsy, glaucoma, and opacity of the vitreous. The most important of these in point of frequency is iritis.

It has been computed by various writers of authority that iritis furnishes from 2.3 to 4 per cent. of all ophthalmic cases, and that syphilis and rheumatism are causative factors of this disease in 90 per cent., in the proportion of syphilis 60 and rheumatism 30.

In the absence of a syphilitic history or signs, one may find a personal or family history of acute or chronic articular rheumatism, symptoms of lumbago, neuralgia, sciatica, torticollis, pains in the articulations or fascia, or sensitiveness to changes in the weather. Many cases are subject to relapses of iritis in spring and winter: seasons of the year when rheumatic affections are most prevalent. Some cases of iritis alternate with rheumatism in other parts, and some recur with the swelling of the joints.

Next in frequency occurs a superficial form of scleritis, episcleritis, which consists of a circumscribed inflammatory nodule generally on the temporal side. It is not movable over the sclera, but firmly attached and of a reddish-violet color. This condition can never be looked on as merely a local disease, but must be regarded as the manifestation in the eye of some systemic derangement. The large percentage, if not all

of them, are associated with the rheumatic diathesis.

The most serious, but, fortunately, rare, rheumatic affection of the eye is deep scleritis. Here the circumcorneal congestion is more general, showing extensive bluish-red discoloration. It is a chronic disease and destructive to vision by the formation of deposits in the cornea and staphyloma of the sclerotic. H. W. Woodruff (*Jour. Amer. Med. Assoc.*, Feb. 9, 1901).

Diagnosis.—The diagnosis is usually easy. Rheumatic fever may be confounded with the secondary multiple inflammation of articulations observed in many acute infectious diseases, such, for instance, as scarlatina, rubeola, diphtheria, pyæmiæ, etc., and also with the pseudorheumatic affections of gonorrhœa, syphilis, and tuberculosis. In all these affections the symptoms of the major infection are present and facilitate the diagnosis.

There exists a syphilitic pseudorheumatism which has only been observed in the secondary stages. This pseudorheumatism differs from ordinary rheumatism by very marked characteristics: Its appearance in subjects free from any hereditary or personal arthritic taint; the habitual co-existence of secondary manifestations; lesser intensity of the inflammatory phenomena; greater fixity of articular determination; and nocturnal exacerbations of painful symptoms. It yields rapidly to specific treatment, but the pains are often assuaged by local applications of salicylate of methyl. J. Steinberg (*Annals de Derm. et de Syph.*, Oct., '98).

Gout.—Gout may be discerned from rheumatic fever by the fact that it is never accompanied by fever of the same intensity as the latter disease. In rheumatoid arthritis the fever is much more moderate.

Case of a boy, aged 8 years, with exceptionally good family and personal history, who complained of great pain and acute sensitiveness in the region of the

umbilicus, with his knees drawn up. Temperature, 102°; pulse, 100. After thirty hours of illness, acute pain and tenderness in the right knee appeared, and before night all the joints of both legs were similarly affected and were red and swelled. By this time the pain in the umbilical region had disappeared. Sodium salicylate given liberally gave much more relief than morphine had. In three days he was entirely relieved. Only in Tyson's "Practice" could the writer find a case of rheumatism simulating peritonitis. He says he treated a case for days for peritonitis, when a few doses of sodium salicylate promptly arrested the disease. R. F. Graham (Phila. Med. Jour., Sept. 30, '99).

Etiology.—Rheumatic fever is a disease which tends to attack young subjects. Infants are almost safe; but the disease has been observed after the age of five years, and it attains its greatest frequency between the ages of twenty and twenty-five years.

Series of 655 cases of acute rheumatism analyzed. Of the whole number 80 per cent. occurred between the twentieth and fortieth years of age, only 32 having occurred in children under ten years. Of the whole 655 cases treated, 22 died, chiefly from cardiac complications, and there occurred 70 relapses. Thomas Whipham (Brit. Med. Jour., Feb. 25, '88).

Both sexes are liable to the disease; men are perhaps somewhat more frequently affected than women, but that is probably on account of their greater exposure to the inclemency of the weather. An hereditary predisposition seems to exist in some families.

Regarding the hereditary tendency of rheumatism, there was personally found among 32 consecutive cases in private practice a definite history of 23, or 70 per cent. If chorea and erythema be regarded as forms of rheumatism, there were 31 out of 33 cases, or 93 per cent. If cases of arthritis, chorea, and heart disease be taken together, 180 cases gave 103 with a definite history, or 58 per cent. If chorea (exclusive of grimacing)

and heart disease are accepted as evidences of acute rheumatism, the proportion rises to 137, or 80 per cent., with a definite family history. Double inheritance increases the tendency remarkably. Exact resemblance of rheumatism in its clinical course and complications with septic disease noted. There are points which militate against the infective idea, such as the hereditary tendency, the absence of a fixed incubation period, and of a definite course. These points, however, are by no means conclusive. The fact that a micro-organism has not been discovered is another inconclusive point against the theory. Cheadle (Brit. Med. Jour., Jan. 11, '96).

Refrigeration and colds were formerly considered as the ordinary causes of rheumatic fever.

Records of about 600 cases of rheumatism studied. Previous health was bad in the majority of cases. Wetting and injuries were chief causes given by patients. When there was no cause known to the patient, excessive indicanuria was found. The joints that were chilled or injured were always the first to suffer. Churton (Brit. Med. Jour., Oct. 30, '97).

The conception of the nature and origin of the disease has, however, completely changed during the last decennium. It is now commonly considered an infectious disease. This view is based mainly upon the facts that rheumatic fever is an epidemic disease and that during the epidemics the cases accumulate in some houses, whereas other houses are quite spared. Norwegian observers have found that the disease does not develop above a certain altitude. It is frequent in the temperate climates only, and is not observed in the tropics nor in the arctic regions. Meteorological conditions do not appear to be of great influence on the epidemics of rheumatic fever: they have been observed as well in the summer as in winter, during dry as well as wet seasons.

Some authors believe that acute rheu-

matism bears some relation to other infectious diseases, as, for instance, endocarditis ulcerosa, meningitis, influenza, myocarditis suppurativa.

In most countries isolated cases of acute rheumatism are always present, but epidemics which vary greatly in intensity and duration occur at irregular intervals.

Although it is commonly admitted that rheumatic fever is caused by an infectious micro-organism, it has not yet been possible to discover this specific microbe. Sahli cultivated material taken from the blood, the synovial membranes, and from the pericardium fourteen hours after the death of a patient suffering from rheumatic fever, and found in all specimens pure cultures of staphylococcus citreus, which he considered as the specific bacterium of the disease. Subsequent observations, however, have not sustained this view, and it is yet dubious whether acute rheumatism is the product of one specific microbe or whether different species act simultaneously as pathogenic factors.

Staphylococcus albus and sometimes streptococci repeatedly found in the synovial fluid of the articulations, in pericardial fluid, and in the cardiac valves in cases of acute and subacute rheumatism. Birch-Hirschfeld, Bouchard and Charrin, Triboulet, Sahli, J. Sacaze (Med. Rec., Dec. 1, '94).

In several cases of rheumatic fever a delicate diplococcus isolated differing from all hitherto described and personally considered to be the cause of rheumatism and its complications. Leyden (Med. News, Jan., '95).

Many cases of tonsillitis are never followed by rheumatism; while repeated attacks may never be so followed, and yet ultimately a similar attack may never be so followed. These facts, taken together, seem to point strongly to the conclusion that there is a special rheumatic bacillus or bacilli; and, further, that this special bacillus may or may

not be associated with those of tonsillitis. That such an association is common and the result immediate cannot be denied. Willoughby Wade (Brit. Med. Jour., Apr. 4, '96).

Ninety-two cases of acute rheumatism examined. In a great number the presence of staphylococci and streptococci was ascertained. Necropsies explain why arthritic effusions in cases of acute rheumatism are found often to be free from microbes, for in such cases the bacteria have their seat in the particular tissues only. These microbes are probably the actual cause of acute rheumatism, which shows its pyæmic nature by its relation to erythema multiforme, sore throat, etc. Singer (Berliner klin. Woch., No. 31, '97).

The infectious nature of rheumatism is beyond doubt when its mode of evolution, its diffuse character, and the fact there is intra-uterine transmission from mother to fœtus are taken into consideration. In many cases some preceding local process has been observed serving as a point of invasion to the organism (whatever it may be) that is the cause of acute rheumatism. Among these, the most important is tonsillitis, and a striking fact is that the organisms found are exactly the same as those occurring in the tissues which are the seat of the location. The pharynx or tonsils—in fact, any tissue showing a lesion—may allow the organism to enter. Jaccoud (Jour. de Méd. de Paris, Apr., '97).

Bacilli cultivated from the blood and the pleuritic exudate of a patient suffering from rheumatic fever, the culture of which prospered particularly in milk and by close exclusion of the air. The bacilli proved toxic to guinea-pigs and rabbits, provoking symptoms of a septic disease, but no affection of the joints. Thiroloix (Gaz. Hebdom., No. 79, '97).

The frequent coincidence of angina catarrhalis generally precedes the rheumatic affection, and both affections are caused by microbial infection. Buss (Deutsch. Arch. f. klin. Med., B. 54).

Some rheumatic manifestations are free from bacterial influence, such as those due to serums, cell-products, etc. No constant specific organism is found

in those forms due to bacteria, and, as the results of infection by those bacteria that are active is not always the same, it is probable that in certain individuals there is a predisposition to articular affections. Cold has an undoubted influence. This influence, however, is limited to the preparation of an already-predisposed individual for microbic invasion by lowering general or local vitality. Acute articular rheumatism thought due to a bacterium with special pathogenicity toward joints and which rapidly loses its virulence. The staphylococcus is the most frequent agent here, both in cases of frank rheumatism and in the joint-affections associated with scarlet fever, puerperal sepsis, etc. Pseudorheumatic affections are due to hæmic infection, from some local affection, such as gonorrhœa, with joint-manifestations. Chronic rheumatism is the result, when the acute attack has largely subsided, leaving only a less active process; or when the pseudorheumatic process has been prolonged, causing permanent joint-changes; or when the resistance of the individual has been so great or the virulence of the micro-organisms so slight that general manifestations were absent. Triboulet (*Revue de Méd.*, Apr. 10, '98).

Number of cases of relapsing rheumatism examined for glandular enlargement in cases in which an infectious origin was suspected. In many of the cases examined it was found that the glands sometimes in the immediate neighborhood of the affected joints became swelled at the time of attack. In most cases there was some pain in the swelled glands. Cultures made on various media from one of the cases were negative, but cover-slips from the joint-liquid and neighboring enlarged glands both showed a diplobacillus. Histologically the enlarged glands showed the lesions of lymphatics with increase in trabeculæ of the glands. This glandular enlargement is regarded as further proof of the infectious character of rheumatism. Chauffard and Ramon (*Revue de Méd.*, May, '98).

Rheumatism is an infectious disease, secondary to some injury to the mucous membranes; particularly those of the

mouth, which permit the entrance of the infectious agent. Reinhard (*Münch. med. Woch.*, Sept. 13, '98).

The presence of lactic acid in the economy is a predisposing cause of rheumatism, but there is no conclusive evidence that it is the exciting cause. The disease is characterized by reduced alkalinity of the blood, and caused by toxic agents whose character and identity are as yet a mystery. C. R. Marshall (*N. Y. Med. Jour.*, Aug. 12, '99).

Achalme in 1891 found an obligate anaërobe bacterium in a state of purity at the autopsy of a man who had died of cerebral rheumatism. This organism, a large rod resembling bacillus anthracis, staining with the aniline dyes and not decolorizing under Gram, has been found by other observers nine times. Sodium salicylate added to the medium hinders the development of cultures. The medium in which the bacillus grows tends rapidly to become acid and unable to preserve the vitality of the organisms. Alkalinization of the medium by calcium carbonate prolongs their vitality. E. H. Wilson (*Brooklyn Med. Jour.*, June, 1900).

A diplococcus found in eight successive cases of acute rheumatism and in five cases in pure culture. They were obtained from the blood of living patients suffering from acute rheumatic pericarditis; from the pericardial fluid and from the fragments of granulations removed from the valves after death; from the throat of the living patient suffering from rheumatic tonsillitis. They were also isolated and grown in an acid medium and also upon blood-agar, and also grown in the pericardial fluid, which on those occasions proved to be acid. They do not thrive on ordinary media and were isolated in pure culture from the joint-exudation, heart-blood, urine from the bladder, and cerebro-spinal fluid of rabbits that have been inoculated with a sufficient dosage. The organism identical with that described by Triboulet and Wassermann a few years ago. Poynton and Paine (*Lancet*, Sept. 29, 1900).

Arguments as to infective character of rheumatic fever.

The clinical features of the disease and its analogy with recognized specific febrile diseases confirm the view that it belongs to the same group. The mode of onset, the frequent occurrence of preliminary sore throat, and the course of the fever point in this direction. It shares its tendency to relapse with such diseases as influenza, enteric fever, scarlet fever, and diphtheria.

The liability to second and later attacks does not preclude this conception of the disease. There is, among diseases admittedly infective, a regular scale of immunity following a first attack from small-pox, in which it is nearly absolute, through enteric fever and scarlet fever, in which it is feebler, to diphtheria in which immunity is evanescent, and down to erysipelas, in which one appears to predispose to further attacks. Rheumatic fever comes at this end of the scale.

Nor can it be said that family inheritance argues against the infective character of rheumatic fever. The special proclivity of certain families to diphtheria, enteric fever, and scarlet fever is notorious. That a special proclivity is required to develop the introduced virus of rheumatic fever may be admitted, but this does not preclude its infective character any more than in the analogous case of erysipelas.

The apparent absence of infection from patient to patient is explicable on the ground that the contagium is buried in the infected joints. Direct personal infection is relatively rare in typhoid fever and cholera, in which diseases the contagium has exit from the patient. It is likely that the majority of the micro-organisms causing rheumatic fever pay for their hardihood in invading the system by securing a sepulture in its cells.

The fact that the joints are the common seat of the trouble favors the infective theory. As Dr. Payne puts it, the "vessels of the synovia of the joints appear to have some special proclivity to form a nidus for the wandering germs of disease."

The therapeutics of the disease confirm the same view. The specific power

of salicin in rheumatic fever is comparable to that of quinine in malaria and of mercury in syphilis. Arthur Newsholme (*Practitioner*, Jan., 1901).

The present state of our knowledge on the relation of tonsillar affections to rheumatism might be summarized as follows:—

1. It is undoubted that a certain number of cases of acute rheumatism are preceded by an angina in a proportion varying from 30 to 80 per cent.

2. Both rheumatism and angina have many etiological points in common: season of year, cold, wet, fatigue, depression, vitiated air, etc.

3. The connection of angina and rheumatism, though undoubted in a number of cases, is not yet clearly established.

4. The tonsil may be the port of entry of the rheumatic virus, and this even though the naked-eye appearance of the throat gives no indication of its being affected.

5. The particular affection of the throat which is associated with rheumatism is not yet established. Apparently it is not peritonsillar abscess.

6. Peritonsillar inflammation does not appear to be arrested by the administration of antirheumatic remedies. Many cases of parenchymatous and lacunar tonsillitis, on the contrary, are considerably benefited by the administration of salicin or salicylate of soda. That this action proved the rheumatic nature of the disease cannot yet be accepted.

7. The question requires further research in two directions: One in differentiating the various forms of angina and determining the one which is associated with rheumatism; the other in further research to discover the true nature of rheumatism. St. Clair Thomson (*Practitioner*, Jan., 1901).

Study of mucus from the tonsils in cases of rheumatism. Diplococci were found in the tonsillar mucus in cases of rheumatism, but not in other cases; they produced a sero-purulent, usually sterile, exudate in the joints, which did not proceed to sepsis. These bacteria have a peculiar affinity to the serous membranes, and the endocardium in particular. This makes it probable that they

have a close relation to actual articular rheumatism. F. Meyer (Deutsche med. Wochen., Feb. 7, 1901).

The discovery of streptococci in rheumatism is not new, but this does not mean that it is without importance. Streptococci and staphylococci are frequently found in almost any infectious disease, and particularly in the mouth and throat. The important feature of some of these organisms, however, is a tendency to cause disorders in the joints. Whether streptococci can be considered as the sole cause of rheumatism or whether the streptococci at times found in normal tonsils lack this tendency to produce joint changes, it is impossible to say. Menzer (Deutsche med. Wochen., Feb. 14, 1901).

Acute articular rheumatism is an infectious disease very probably induced by a specific bacterial excitant. The claims of Achalmé and others that the infection is attributable to an anaërobic bacillus have not been sustained and are very probably untenable. The correctness of the contention advanced by Singer that the disease is a modified pyæmia is very doubtful. It is probably much safer to say that secondary infection with pyococcal bacteria is common in this disease. The diplococcus isolated by Wasserman, Poynton, and Payne, and several others, is probably a modified streptococcus. All of the inoculation results induced by this assumed specific diplococcus may be obtained with the streptococcus pyogenes. The demonstration of this organism, then, as the causative factor of rheumatic fever is incomplete. The specific bacterial excitant of the disease still remains to be discovered. A. J. Lartigau (Albany Med. Annals, May, 1902).

The writers formulate the following provisional statement: The *micrococcus rheumaticus* produces formic acid in very considerable quantity, and also at least one other acid of the fatty acid series. The acid (formic) is not only present in the filtered cultures of the organism, but can also be extracted from the bodies of the micro-organisms themselves. The washed micrococci contain, in addition to formic acid, at least

one of the higher fatty acids. Ordinary streptococci, such as a streptococcus isolated from a case of erysipelas, only give rise to a small amount of formic acid. This observation may constitute a means of differentiation between the rheumatic micro-organism and other members of the streptococcus group. Formic acid and probably another fatty acid are present in the urine during the course of acute rheumatism in appreciable amounts. From normal urine formic acid is either altogether absent, or it occurs in traces only. Under the salicylic acid treatment of rheumatism, formic acid is reduced in quantity in the urine of the patient. Formic acid is obtainable from the tissues of an animal (rabbit) suffering from acute arthritis due to the inoculation of the micro-organism. E. W. A. Walker and J. H. Ryffel (British Medical Journal, Sept. 19, 1903).

Pathology.—In all cases of rheumatic fever congestion and hyperæmia are present in the joints; but as these alterations are extremely fugitive it is ordinarily impossible to demonstrate them by the autopsy. In more advanced cases the synovia is augmented and shows microscopically a great number of cells containing many nuclei and molecules of fat, resembling pus-cells. In some cases the cells are not free, but are contained in a net-work of fibrin, appearing to the naked eye as small flakes. True pus is not found in the joints except when other infections have invaded the body at the same time as the specific infection of the rheumatic fever. The synovial membrane of the affected joints is red and swelled, with turgid prominences, and its capillaries are gorged with blood; the cells of the synovial membrane tend toward multiplication, containing 10 to 12 nuclei. The cartilage is also involved; its cells multiply and form oblong capsules containing many secondary capsules. The

macroscopical result of these alterations is that the cartilage has lost its natural polish and that it is finely striated. All these pathological changes are common to every case of acute arthritis and are not specific as regards the rheumatic joint-affection.

The rheumatic alterations of the endocardium, the pericardium, etc., revealed by autopsy present the ordinary signs of an acute inflammation, but nothing which is characteristic of rheumatic fever proper. During the course of the latter the blood is in a morbid state, containing much more fibrin than healthy blood; when evacuated it forms a small clot covered by a thick layer of fibrin, and when a drop of blood is placed under the microscope an abundant net-work of fibrin appears. The other constituents of the blood are diminished, the solid contents of serum ranging from 60 to 80 per mille. The number of red corpuscles is considerably diminished, while the proportion of hæmoglobin present is 7 per cent. instead of the normal 13 per cent. While the number of red corpuscles may decline to one million per cubic millimetre, the white corpuscles increase and reach in some cases the amount of 20,000 per cubic millimetre. Milk acid, urea, and uric acid have often been sought for, but have never been found by the chemical examination of the blood taken from patients suffering from rheumatic fever.

Conclusions regarding influence of uric acid as an active and efficient influence in production of acute articular rheumatism.

1. That any diminution of the alkalinity of the blood and tissue-fluids in a given region of the body causes the uric acid coming to it in the blood to become less soluble and more easily retained; in other words, causes it to remain in the fluids of the less alkaline

region, instead of passing on in the circulating blood. The blood thus becomes poorer, and the region of diminished alkalinity richer in uric acid or biurate.

2. According to Sir A. Garrod, certain regions and tissues, as the liver, spleen, and the cartilages and fibrous tissues of joints, are normally less alkaline than the other tissues of the body and their fluids; hence, in any general diminution of alkalinity these tissues will be most affected, and the circulating uric acid will first of all be rendered insoluble or retained in them.

3. It follows, from what has been said, that the uric acid, or biurate, thus concentrated or precipitated in certain tissues, gives rise to irritation, going on to inflammation, which is roughly proportional to the amount of uric acid concentrated in any given spot, and the time during which it can act upon the tissues. It may be noted that when any tissue or organ is thus collecting and retaining, so to speak, all the uric acid that comes to it in the blood-stream, and while the local pains in the tissues concerned are increasing, the blood grows poorer in uric acid; as a normal consequence of this, the amount excreted in the urine diminishes, so that we have an independent source of evidence as to what is going on. Conversely, when an alkali or other solvent of uric acid has been introduced into the circulation, the process is reversed; the blood passing through the irritated tissue now takes up in solution the uric acid that was previously retained or deposited; the affected organ or tissue grows poorer in uric acid, while the blood grows richer; and, as an evidence of this latter change, there is an increased excretion of uric acid in the urine.

By assuming that the chief predisposing causes of rheumatism diminish the alkalinity of the blood, or of the fluids of local tissues, it is plausibly explained in the foregoing conclusions how the uric acid, rendered less soluble, is attracted to and made to accumulate in the tissues sufficient to cause pains and rheumatic inflammation, while the blood in general circulation and the urine would yield less than natural, when sub-

jected to the usual tests. A. Haig (Practitioner, Feb. to Apr., '91).

Lactic acid is the direct cause of the active symptoms of rheumatism. An excess of this acid is generally produced by eating too freely of food containing a large percentage of starch and sugar or proteids, and thereby introducing more than can be completely oxidated. By such incomplete oxidation of the proteid compounds within the system, the percentage of urea in the urine falls, uric acid increases, and lactic acid appears in large quantities; and to this might yet be added a long list of other by-products. But it is the lactic acid that chiefly appears in rheumatic affections. W. H. Porter (Amer. Medico-Surg. Bull., Jan., '93).

From chemical experiments the following conclusions have been reached. The phenomena of rheumatism rest upon the accumulation of urate spherules in the connective tissue and cartilage.

The alkalescence of juices of connective tissue is due to sodium carbonate (not the bicarbonate or phosphate).

Acids favor, in the extreme, the precipitation of the spherules, while alkalis are in the opposite extreme of preventing this precipitation. Sodium salicylate favors the transformation of urate spherules into urate needles. This explains why this salt cuts short the inflammatory process, but predisposes to relapse, which is due to the needles' persistence in the tissues. Urate spherules are naturally subject to oxidation; urate needles are not. Sodium carbonate and bicarbonate do not directly hasten solution of needles, but probably favor oxidation of spherules. These salts are best given in mineral waters free from lime and containing sodium chloride and carbonic acid. Mordhorst (Centralb. f. Inn. Med., No. 19, '98).—

In rheumatic fever, even in the most subacute attacks, acute dilatation of the heart seems to be invariably present. Since the author first observed its occurrence in 1894 he has never seen a first attack of this disease, whether in a child or in an adult, in which it was absent. When the rheumatic attack is over, the dilatation lessens and the cardiac dull-

ness may again become of normal extent. One may say with certainty that an acute dilatation of the heart is much more common in rheumatism, even in slight attacks, than in either diphtheria or influenza. Yet, though more common, it is far less dangerous. An extension of the cardiac dullness to two finger-breadths outside the left nipple-line is an indication of grave danger in a child affected with diphtheria; but the same amount of increased dullness in a child suffering from rheumatism implies, in itself, no immediate danger of death whatever.

The dilatation of rheumatism is so much less dangerous than that of diphtheria or of influenza, in spite of its greater frequency in considerable amount. The difference must be produced by a different effect of the several toxins upon the cardiac muscle. In diphtheria, and apparently in influenza, the muscular fibres of the left ventricle suffer greater destruction; in rheumatism the myocardial changes are less intense, and one can only suppose that the elasticity of the ventricle is more affected. Dr. Poynton's section shows that, though in the rheumatic heart there is evidence of fatty degeneration of the cardiac muscular fibres, with interstitial foci of small cells and vascular dilatation, yet the destruction of the muscle is much less pronounced than in the diphtherial heart.

But though an increase of cardiac dullness to two finger-breadths outside the nipple-line in a case of rheumatism involves no danger of sudden death, yet a further extension, occurring rapidly, may cause decided symptoms of collapse.

The slightest suspicion of rheumatism in a child should therefore lead to careful and repeated examination of the heart. Even in adults, much oftener than is generally recognized, it is fresh rheumatism that kills, breaking down compensation. It is important to notice that at the necropsy of patients who have died from chronic rheumatic heart disease, there is usually evidence of fresh endocarditis on the cardiac valves. And clinically it may often be observed that, when a case of mitral stenosis breaks

down, there is some evidence of fresh rheumatism. D. B. Lees (Brit. Med. Jour., Jan. 5, 1901).

Prognosis.—The prognosis is rather good as regards life, as very few cases end in death (0.3 per cent.). Complications, particularly those involving the heart, are, however, frequent and often lead to serious consequences.

The gravid state renders acute articular rheumatism more serious and increases the difficulty of cure. Von Noorden (Inter. klin. Rund., Apr. 23, '93).

The immediate prognosis in rheumatic heart disease in children is good, the remote prognosis always grave, the end occurring in youth or early adult age. J. L. Steven (Brit. Med. Jour., Oct. 15, '98).

In the prognosis of any case of rheumatic heart disease the two influencing factors should be the presence of widespread pericardial adhesions and the persistent recurrence of rheumatic manifestations. Osler (Brit. Med. Jour., Oct. 15, '98).

Treatment.—In the treatment of rheumatic fever it is of importance that the patient be placed in a large, well-ventilated room. The diet should be frugal; during the febrile period liquid food must alone be given, with lemonade, carbonated waters, and milk as beverages. The bowels ought to be kept regular.

Many authors deem it preferable to commence the treatment by giving a free purgative.

As a specific remedy against the infection itself, salicylic acid and combinations containing this drug have nearly supplanted all other drugs. Salicylic acid may either be given pure or in combination with alkalines (sodium or strontium). Pure salicylic acid is best tolerated when it is given in capsules, containing, each, $7\frac{1}{2}$ to 15 grains of the drug; this dose is to be repeated four, five, or even six times per day, until the

pain is relieved and the temperature falls. When symptoms of intoxication (such as tingling in the ears or nausea) appear the use of the remedy must be discontinued or the dose greatly reduced. In many cases the pain is very rapidly relieved by this treatment and patients who, in the morning are not able to move, are completely relieved after a treatment of twelve hours. In other cases the fever disappears, but the pain and swelling of one or more joints continue for some time. Even when all symptoms have disappeared, it is advisable to continue the use of salicylic acid for some time, but in lesser dose. When the use of salicylic acid is discarded too soon, recurrence is apt to occur.

Salicylic acid used in twenty-five cases in the form of a 20-per-cent. ointment rubbed into the skin. In most of the cases the therapeutic effect was most decided Hasenfeld (Pester Med.-chir. Presse, No. 47, '94).

In articular rheumatism the following ointment is valuable:—

R̄ Salicylic acid, 45 grains.
Oil of turpentine, $\frac{3}{4}$ drachm.
Adeps lanæ, 5 drachms.
Lard, 5 drachms.

This is spread over the parts, and a dressing of absorbent cotton applied and covered with any impervious material. Bourget (Jour. des Prat., No. 29, '98).

Many authors prefer the use of the salicylate of sodium, which is commonly given in solution, 1 to $1\frac{1}{2}$ drachms or even 2 drachms being administered. It has the same effect on the disease as the pure acid.

In acute rheumatism it is not best to give large amounts of the salicylates, for they have a depressing effect upon the patient. It is well also to combine a little colchicum with the salicylates. Chloride of ammonium and acetate of potash, 10 to 15 grains each every two hours, have been used with good results. Robinson (Med. Rec., Feb. 1, '96).

Grave consequences may result from the employment of sodium salicylate in acute rheumatism with visceral localizations, for it neither cures nor prevents them, but may favor production. The drug should be suspended when delirium sets in before the diagnosis of cerebral rheumatism is established, or if the delirium be of an alcoholic or hysterical nature, or result of any intoxication. In cardio-pulmonary complications the same is true. Salicylates lower the fever and relieve pain, but do not influence at all these localizations. By persisting in their employment, involvement of the myocardium is hastened. Jaccoud (*Lyon Méd.*, Mar. 14, '97).

In the rheumatism of children full doses of sodium salicylate are not required; and they may be harmful from their depressant effects. The milder drug, salicin, may be substituted in most cases in doses of 5 to 20 grains; or quinine in doses of 1 to 3 grains every four hours. In each case an alkali, sodium or potassium citrate, should be combined and given in doses according to age. The use of depressant drugs—as antipyrine, antifebrin, and aconite—with a view of lowering temperature cannot be too strongly deprecated.

Gibson found that cases of acute rheumatism treated by rest escaped permanent heart-lesion in the proportion of two to one compared with those permitted free action. When pericarditis supervenes, if there is much pain and distress, one or two leeches may be applied to the præcordia. The most effective local application is that of the ice-bag.

In the deadly form of cardiac inflammation persistent, recurrent, subacute endocarditis, and pericarditis, opium, digitalis, and strophanthus, with an alkali, are the drugs of most service. Alcohol is also a most useful agent.

As a last resource, in the case of older children only, when the heart shows signal signs of failure, when the first sound becomes short and feeble, and the pulse small and irregular, hypodermic injections of liquor strychniæ, combined with brandy or digitalis, are valuable. Cheadle (*Treatment*, No. 5, '97).

Rheumatic fever most successfully treated by giving a combination of a salicyl compound with an alkaline bicarbonate. For an adult 20 grains of sodium salicylate and 30 grains of potassium bicarbonate should be given every two hours until the pain is relieved and the patient is fully under the influence of the salicylates, when the same quantities should be given every four hours till the temperature has fallen to normal. Afterward 15 grains of the salicylate and 20 grains of the bicarbonate are to be given every four hours until all the joint symptoms have disappeared, and then three or four times a day until a fortnight has elapsed from the complete disappearance of joint symptoms. During the whole of this course of treatment absolute rest in bed must be enforced. A. P. Luff (*Practitioner*, Jan., 1901).

The writer lauds the method advocated by Mendel for the treatment of rheumatic conditions by means of the injection of a salicylate solution consisting of sodium salicylate, 8.0; caffeine sodio-salicylate, 2.0; distilled water, ad 50.0. The therapeutic results of this method are excellent, and prompt relief is afforded in nearly all forms of rheumatic affections. A careful diagnosis is necessary, however, for non-rheumatic disorders are not amenable to this plan of treatment, and the effect in rheumatic cases is less pronounced the longer the duration of the trouble has been. The injection should be made with all due aseptic precautions, and care should be taken to see that the presence of the point of the needle within the lumen of the vein is demonstrated by the appearance of a column of blood within the syringe before the fluid is expelled, as the solution gives rise to severe pain if thrown into the tissues instead of directly into the vein. The author has seen no disagreeable complications attend the method when carefully employed, and recommends it especially for cases where it is of great importance not to upset the stomach, as in treating tubercular patients, for example. Behr (*Münchener med. Wochen.*, Nov. 8, 1904).

Nothing certain is known of the manner in which salicylic acid and its combinations influence the rheumatic infection; possibly it has a specific action on the microbes; it is a reliable, but not an infallible, remedy, and some cases are rebellious to its action. Some patients do not tolerate it, vomiting being induced. It may then be administered by inunctions (*vide supra*) or enemata.

An aqueous injection should first be given patient to evacuate intestines, and the solution should be heated to a temperature equal to that of the human body.

Following formula given preference:

R Salicylate of soda, $1\frac{1}{2}$ to 2 drachms.

Water, $3\frac{1}{2}$ ounces.

Tincture of opium, $1\frac{1}{4}$ drachms.

Best instrument for giving this enema is the ordinary injection-syringe of $3\frac{1}{4}$ ounces' capacity, joined with an œsophageal sound, which may be made to penetrate about eight inches into the large intestine. It is important that the injection be retained as long as possible in the intestines. Erlanger (Deutsches Archiv f. klin. Med., vol. iii, '93).

Methyl-salicylate used in eighty-five cases of acute and subacute rheumatism internally, starting with doses of 15 to 30 minims a day, and increasing the daily doses up to 2 or $2\frac{1}{2}$ drachms. Formula used:—

R Methyl-salicylate, 2 drachms.

Gum-arabic mixture, 5 ounces.

Rum,

Syrup, of each, 6 drachms.

To be taken during the twenty-four hours.

Amyl-salicylate is the equal of sodium salicylate as an antipyretic and analgesic, and is better borne by the stomach. Some cases, however, showed the following untoward effects: Noises in the ears, headache, vertigo, dryness of the throat, nausea, vomiting, burning in the stomach, etc. Its absorption is very rapid; in most cases salicylic acid can be discovered in the urine within twenty-five minutes after the administration of the

drug. Corma (Le Bull. Méd., p. 909, 1900).

Salophen, a drug which in the bowels decomposes into salicylic acid and phenol, has been recommended as a substitute for salicylic acid. It is especially useful when given late in the course of the disease, when the acute fever has been mastered by the salicylic acid. Salophen is well supported even under prolonged use. The daily dose is 1 to $1\frac{1}{2}$ drachms.

Salophen recommended in acute rheumatism in doses of 15 grains every three hours, in conjunction with sodium bicarbonate, 10 grains three times a day. W. H. Flint (N. Y. Med. Jour., July 30, '92).

It is in the acute variety of articular rheumatism that the good effects of salophen are manifested. It should be administered at the outset in daily amount of 90 grains taken in six doses in starch-wafers. It is always well borne; there is no malaise, nausea, vertigo, or ringing in the ears. In equal dose it is a little less rapidly efficacious than sodium salicylate. M. L. Galliard (La Presse Méd., No. 56, '97).

Salophen in forty cases of rheumatism, giving 15 grains six times daily. It has a good effect in acute and chronic articular and muscular rheumatism. Klimenko (Ther. Monats., July, '98).

Excellent results obtained with salophen. It is best administered in wafers, or simply dropped on the tongue. It passes unchanged through the stomach, and, in the intestines, it separates into salicylic acid and acetyl-paramidophenol, the latter having antipyretic and analgesic properties, and supplementing the action of the salicylic acid. The separation is probably very gradual, as the salicylic acid which is formed causes no untoward symptoms whatever. H. A. Richy (Buffalo Med. Jour., Feb., 1901).

Of late a compound of salicylic acid, salicylate of methyl, has been recommended for external use; it is a volatile fluid of an aromatic odor; the pure drug is preferable to wintergreen-oil, a veg-

etable extract employed by perfumers and containing a large percentage of salicylate of methyl. The affected joints are to be painted with the drug and enveloped with some impervious material. Experience has shown that the salicylic acid contained in methyl-salicylate is absorbed through the skin. It is also chemically demonstrable in the urine. It removes the pain and reduces the temperature of rheumatic fever.

Local application of salicylate of methyl used in different forms of rheumatism (acute, subacute, and gonorrhœal, etc.). The drug must be used in cases in which for any reason it is desired to obtain a local effect, and when the ordinary remedies for rheumatism are not well borne by the stomach. Salicylate of methyl acts well in acute articular rheumatism, but on account of the difficulty of applying it to painful joints it must be employed in such cases only if the internal administration of remedies has failed. On the other hand, in subacute and chronic forms, in the painful paroxysms which occur from time to time in the different varieties of deforming rheumatism, local absorption of salicylate of sodium acts as well as salicylates taken by the mouth, often better. Lannois and Linossier (*Méd. Mod.*, Aug. 19, '96).

Following suggested as summary of the chief points in reference to the prophylaxis of rheumatic hyperpyrexia: 1. Cases in which the pyrexia shows a tendency to rise instead of decline under full doses of the salicyl-compounds, and in which no intercurrent condition can be detected which might account for the increasing pyrexia, should be treated at once by cold applications without waiting for the onset of nervous symptoms or for other prodromata of rheumatic hyperpyrexia. 2. When delirium appears in a case which exhibits pyrexia, and no intercurrent visceral complication can be made out which might account for its presence, the immediate employment of cold is called for. 3. Should delirium appear while the temperature remains normal, a mild form of cold application

—*e.g.*, an ice-cap to the head—should be employed, and on the appearance of pyrexia more vigorous methods ought to be adopted without waiting for any extreme degree of pyrexia (*e.g.*, 105° F.) to be reached. 4. Cases in which the hyperpyrexia is, as it were, accidentally discovered to be present offer, of course, no field whatever for prophylaxis, but treatment by cold should be commenced at once without waiting for the appearance of nervous symptoms or attempting to reduce the temperature by means of any antipyretic drugs. H. G. Langwill (*Scottish Med. and Surg. Jour.*, Feb., '99).

The hypodermic injection of tropacocaine, in the form of a Schleich infiltration, accomplishes therapeutic results not approached by any other method in the relief of the agony of neuralgias and myalgias of rheumatic origin. The injection should be made in the area of greatest tenderness to pressure, and varies slightly in technique from that practiced for surgical purposes, inasmuch as it demands the injection of as large quantities of the fluid as possible, with a syringe capable of exerting powerful pressure. The method is successful in acute, subacute, and chronic cases in which fibroid changes have not already taken place; furthermore, it offers a sign of diagnostic importance, since it offers relief only in the neuralgias of rheumatic origin. In rheumatic affection of tendons and joints it is available only in very light cases, with small amounts of exudation. R. Bloch (*Medical News*, May 23, 1903).

As the long-continued use of salicylic acid is not without inconveniences, different other antipyretics have been tried as substitutes for it; such are antipyrine, antifebrin, salol, phenacetin, malakin, analgen, asaprol, pilocarpine, etc. Each of these drugs has in some cases proved successful; none of them, however, has any chance of supplanting salicylic acid as the most ready and reliable remedy.

In acute articular rheumatism ichthyol (25 to 100 per cent.), rubbed into the affected parts, has seemed to relieve

pain without causing irritation. Personal preference, however, is for a mixture of salol, ether, and collodion—of the first two, a drachm each, to an ounce of the latter—painted on the affected joints twice or oftener daily; this has certainly resulted in relief of pain, even if no permanent benefit ensued. Sodium salicylate exerts a more prompt and decided action than salicylic acid, and should be given to an adult, 10 to 20 grains every two to four hours until the desired effects are obtained, or until tinnitus is induced, after which the dose may be lessened or salicin substituted. Baker (*Amer. Pract. and News*, July 11, '96).

Hydrotherapy recommended for rheumatism, the following methods being used: (1) the administration of pure, soft water at frequent intervals, about 4 litres being given to an average man per day; (2) irrigation of the intestinal tract with water to which a little liquid soap has been added; (3) thorough moistening of the body, either by bathing, the wet pack, or by sprinkling. E. Lee (*Jour. Amer. Med. Assoc.*, July 25, '96).

Ichthyol applications, employing one of the following formulas, recommended in articular rheumatism:—

1. R̄ Ichthyol, 10 grammes.
Distilled water, 10 grammes.
Adeps lanæ, 30 grammes.
2. R̄ Ichthyol, 10 grammes.
Adeps lanæ, 20 grammes.
Extract of bellad., 1 gramme.
3. R̄ Ichthyol, 10 grammes.
Diluted alcohol, 10 grammes.
Distilled water, 40 grammes.—
M.

Arendt (*Jour. des Prat.*, No. 29, '93).

Methylene-blue employed in rheumatism. It does not diminish pain, but lessens fever. In treatment of rheumatism its value is equal to salicylate of soda. It is necessary to employ a pure product. Le Moine (*Le Prog. Méd.*, Feb. 4, '99).

Aspirin has only a slight taste and can be easily administered, being given diluted with sugar and water on a spoon or in milk. As it is insoluble in acid fluids, it passes unaltered through the stomach into the intestinal canal, where

it is decomposed and absorbed in the form of nascent salicylic acid.

Aspirin shortens the course and severity, and relieves the pains in rheumatism. It does not act as the salicylates do on the stomach, and does not produce tinnitus or headache. It seems to reduce temperature, and has no bad effects on the heart or nervous system. C. A. Protin (*Merck's Archives*, July, 1901).

The complications of the acute articular rheumatism are to be treated according to their nature and the indications of each; the hyperpyrexia and the cerebral rheumatism may necessitate the application of tepid and even cold baths combined with large doses of antipyretics; in the complication with endocarditis digitalis must be employed, etc. When the fever declines, but one or more articulations remain swelled and painful, it has been recommended to employ bandage for some time. Also baths of hot water or, better, of hot air will in many cases bring relief.

If murmurs appear the cardiac condition should be closely watched for at least four weeks, during which period treatment by means of sodium salicylate should be continued; the patient should remain absolutely at rest in bed, and all excitement must be avoided. When acceleration of the pulse is noted sparteina in the following formula is prescribed: sparteina sulphate, 1; syrup of tolu, 10,000; distilled water of linden, 20,000. Of this two tablespoonfuls are given daily. Precordial pain calls for counterirritation by means of cupping or vesicants, which measures should be continued if the pain persists. If the pulse becomes irregular, as well as rapid, digitalis in the following formula: powdered digitalis leaves, 50; water, 120; fluid extract of convallaria, 30. The daily dose of this mixture is 7 to 8 drachms. Caffeine should not be employed unless myocarditis is present. F. Combemale (*Annales de la Polyclinique de Paris*, No. 11, p. 261, 1903).

Hot, dry air, though an old remedy, has recently been considerably used, such reliable writers as Landouzy and Déjerine, of Paris, having reported marked success with it at temperatures varying from 200° to 250° F., in the various forms of rheumatism.

According to A. Graham Reed (N. Y. Med. Jour., Sept. 17, '98), the blood becomes heated from 1° to 5° F., and this seems to be the therapeutic factor. The heat stimulates vascular activity, reduces localized congestion, and stimulates metabolism. Profuse diaphoresis is promoted without the unpleasant head-symptoms usual in a steam-bath, as the patient breathes the ordinary air of the room.

Various effects of local application of superheated air. Local and general perspiration is induced in amounts from 16 to 25 ounces; to this loss of perspiration the reduction of body-weight is due. The body-temperature rises, but usually less than 2° F. The pulse-rate increases slightly during the application of the method, and upon its cessation gradually returns to its normal rate. Hence the harmlessness of the method, and its slight and temporary influence upon the general condition. M. Mendelsohn (Zeit. f. Diätetische u. Psych. Ther., H. 1, S. 52, '98).

No treatment has been found able to prevent surely the complications or recurrence, but most authors agree that the use of salicylates in sufficient doses continued for some time after the return of normal temperature gives the best results in both respects.

When there is much effusion into the joints the absorbed toxic products cause the serious constitutional symptoms. Surgical interference is warranted when an obstinate effusion is inducing toxæmia, or a chronic effusion endangers the usefulness of the affected joint, without causing much systemic disturbance, while early drainage lessens the chances of heart lesions. O'Connor, of Buenos Ayres,

has abandoned medication in such cases, and opens and drains a joint as soon as the diagnosis is made. While this is too radical, surgical interference is indicated in cases in which it is more dangerous to wait than to operate, and in chronic cases in which the patient's earning capacity is interfered with to a material extent. A. T. Bristow (Brooklyn Med. Jour., June, 1900).

Chronic Articular Rheumatism, or Rheumatoid Arthritis.

Synonyms.—Rheumatic gout, *rhumatisme chronique infectieux*, polyarthrititis deformans.

Definition.—A chronic polyarticular disease allied in some respects to rheumatism and due, in all probability, to the invasion of micro-organisms.

In osteoarthritis or rheumatoid arthritis there are three types: (1) an acute polyarticular disease; (2) a chronic polyarticular disease of primary and secondary forms; (3) a monarticular disease. There is no connection between the acute polyarticular and the monarticular affection, or between the latter and the chronic polyarticular condition. G. A. Bannatyne (Practitioner, May, 1900).

Symptoms.—Rheumatoid arthritis presents few or perhaps no premonitory symptoms, although some patients claim that they have felt pains in the ball of the thumb or in the wrist a short time before the appearance of the affection in the joints. The disease itself begins with swelling of one or more joints, the latter assuming a spindle shape. The skin becomes reddened or bluish; the local temperature is raised one or two degrees. In some cases the affected joints present an elastic swelling with distinct fluctuation; in other cases a soft, flabby enlargement is witnessed, or crepitation may be elicited from the start by passive movements. Pain is almost constantly complained of, caused particularly by motions of the joint; but in the more acute form of the disease it

is also present during rest. Synovial pouches are sometimes found in the proximity of the joint which insinuate themselves between the muscles and tendons. This is especially observed in the small joints of the fingers.

The affection usually begins at the fingers, but from there it spreads upward to the larger articulations; and the elbow, shoulder, knee, and even the hip may successively be attacked. In the larger joints an effusion of fluid, sometimes quite profuse, is often observed. The affection ordinarily spreads from the periphery toward the centre and a certain degree of symmetry is commonly noticed with regard to the joints affected and to the time of their invasion.

All joints are liable to be attacked by the disease, even those of the spine, the ribs, and the jaws. The different articulations are involved with varying frequency, as shown by the following statistics of Garrod and Bannatyne:—

	BANNATYNE.	GARROD.
Hands affected . . .	97.4 per ct.	86.0 per ct.
Elbows	84.6 per ct.	25.0 per ct.
Neck	82.0 per ct.	
Knees	73.0 per ct.	60.6 per ct.
Ankles	67.9 per ct.	34.4 per ct.
Jaws	67.9 per ct.	25.0 per ct.
Shoulders	61.9 per ct.	25.0 per ct.
Hips	12.5 per ct.	14.6 per ct.
Sterno-clavicular . .	2.5 per ct.	

Ankylosis either from fibrous changes or from interlocking of the osteophytic outgrowths (often observed in the jaws) frequently results. Another frequent sequel of the disease is deformity of the articulations, due to dislocation of the bones; this is particularly observed in the hands and in the knees. In the hands there may be deflection to the ulnar side, or, more rarely, to the radial side. Flexion and hyperextension may also be observed and every possible combination of these deformities may occur.

While these deformities develop, the knuckles and the wrist become enlarged and nodular and the muscles of the fingers atrophy; as a rule, the thumb escapes in the less severe cases, but is affected when the disease is more general. The deformity of the knee ordinarily consists in flexion and some rotation of the foot outward; in some cases there is much fluid distending the knee, in others the ligaments surrounding the joint present a pulpy softening which may easily be confounded with effusion in the joint. In a third type we only find enlargement and immobility of the heads of the bones. The deformities of the joints are caused by the weakness of one set of muscles, these being overcome by the greater strength of other muscles and by the diminished power of the softened ligaments. Pain is present in almost all cases, but its intensity varies according to the severity of the case and the stage of development.

Cardiac symptoms are present in a certain portion of cases (7.9 per cent., Bannatyne); the lesions of the heart are, however, not so severe or so extensive as in the acute articular variety. In a considerable number of cases there is enlargement and tenderness of glands, corresponding to the affected joints. The skin shows small fibrous nodules, as in acute articular rheumatism. In all acute cases atrophy of the muscles especially of the extensors and the interossei is observed; the tendon-reflexes are often slightly increased.

Fever is always present in the acute stage, but it is irregular and not of a very acute type. The temperature seldom or never rises so high as in the rheumatic fever. The pulse is higher than usual, but even in the later stage of the disease, when the fever has passed

away, a pulse of from 80 to 100 is no rare occurrence.

Anæmia is always observed in rheumatoid arthritis, especially marked in the very acute cases and in the chronic forms of very long standing. Hæmorrhages are rare, but spots of purpura are witnessed.

Neuritis often spreads from the affected joint to the nerves in its proximity; pain along the course of the nerves is experienced. Faradic irritability is lost, but that to the galvanic current is increased; commonly the disease from the first affected nerves spreads to other branches. A polyneuritic inflammation, symmetrical in development, may also be observed. The skin may show pigmentation, or that covering the diseased joints (glossy skin) becomes atrophied. Erythema and œdema are also met with. Sweating is observed in almost all cases. The urine is, as a rule, normal.

The disease may assume an acute type. This is particularly the case in children and young adults. The onset of this form is characterized by pyrexia, thickening of the joints affecting the synovial membranes and cartilages as well as the ligaments around the affected joint, but without osteophytic changes. The glands are always enlarged.

At first the disease only attacks one or a few small joints of the hand or the foot; but from there it spreads very rapidly to most other joints of the body, affecting them symmetrically. In the early stages the articulations are soft, doughy, and swelled; later on they become harder and stiffer. The other symptoms—atrophy of the skin and of the muscles, etc.—develop in a short time. The pain is very marked, and sometimes sleep can only be obtained by

narcotics. Complications in the direction of the heart are very common.

The chronic form of rheumatoid arthritis is either the later stage of the acute form or the disease may from the beginning take a chronic course, spreading much more slowly and producing thickening and hardening of all the tissues of the affected joints as well as osteophytes, deformities, ankylosis, etc. Fever is absent or is of no importance, the pain much less marked, and the glands commonly remain normal.

Diagnosis.—Rheumatoid arthritis may be confounded with the pathological changes caused by chronic gout, or by some diseases of the nervous system (tabes, syringomyelia, etc.) and with the sequelæ of acute rheumatism, tuberculosis, gonorrhœa, syphilis, etc.

Records of 37 recent cases with a history of pain in one or more joints analyzed. Four were due to traumatism, in 2 cases with painful ankles and feet the patients had flat-feet, 4 were afflicted with rheumatoid arthritis, and 6 were distinctly gouty. In the remaining 21 cases, all complaining of chronic rheumatism or of an excess of uric acid in the system, there was a previous history of 5 cases of acute articular rheumatism, in 1 of small-pox, in 8 of gonorrhœa, in 2 of syphilis, 1 was tuberculous, and in 4 cases no satisfactory previous history could be obtained. Of the above 21 cases, indistinguishable as far as clinical appearances go, no less than 17 gave the history of having previously suffered from some disease of microbic origin. Some recent contributions to the literature of this subject are referred to, dealing especially with the results of infectious disease producing subsequent joint lesions. A clear classification of joint affections may be made according to their pathogenesis in one or other of the following divisions or combinations of them: (1) traumatism, (2) bacterial infections, (3) toxins and other chemical irritants, (4) nerve-degeneration. Merrens (*Medical Record*, March 22, 1902).

From CHRONIC GOUT rheumatoid arthritis is distinguished by the absence of the characteristic features of gout. There is no history of attacks of acute gout, no affection of the kidneys, and the patient has not suffered from uric-acid gravel or sand. Examination of the sediment by means of the centrifugal apparatus reveals no renal casts—always present in chronic gout—in the urine.

Lastly the Roentgen radiograms of the two affections are of a totally different appearance: in gout the uratic deposits are permeable to the Roentgen rays, and do not show, therefore, in the photograph; the bone-heads of the diseased joint appear in clear outline, a distinct, clear space representing the cavity of the joint and the cartilages. In rheumatic gout the heads of the bones always appear obscure and deformed; even in acute cases, or when much mobility of the affected joint is still left, the photograph looks as if the two bony heads were melting together.

LOCOMOTOR ATAXIA. — In tabes and other serious nervous affections the joints may be diseased in a manner much resembling rheumatoid arthritis; in such cases the Roentgen photogram is of great value; when the affection is due to lesions of the nervous system, rapidly progressing absorption is found in the bones, and only portions of the bones are visible in the photogram, while large portions of them have totally disappeared.

The points of special significance in the diagnosis of rheumatoid arthritis are: 1. The sex and age of the patient. 2. The soft spindle enlargement of the finger-joint and the swelling of the wrists; together these form the most constant symptom, and in nine cases out of ten the disease can be easily and certainly diagnosed from the hand alone. 3. The cold, sweating pains. 4. The af-

fection of the jaws and neck. 5. The cachexia and wasting. And, of less importance: 6. Pigment-changes. 7. Tachycardia. Gilbert A. Bannatyne, Arthur S. Wohlmann, Frank R. Blaxall (*Lancet*, Apr. 25, '96).

There is a disease occurring in children before the second dentition which is characterized clinically by elastic, fusiform enlargement of joints, without bony change, and also by enlargement of the glands and spleen.

The disease has hitherto been called rheumatoid arthritis, but it differs from that disease in adults clinically in the absence of bony change even when no disease is advanced, and in the enlargement of glands and spleen, and pathologically in the absence, even in advanced cases, of the cartilaginous changes, which are found quite early in that disease, and also in the absence of osteophytic change. Still (*Medico-chir. Trans.*, '97).

Etiology. — Authors have disagreed very much regarding the etiology of this disease. Some have held it to be a secondary affection, consecutive upon acute articular rheumatism, while others have connected it with gout or believed it to be a senile change of the joints. Again, others have argued that it is caused by some abnormal nerve-condition having its seat in the cord or in the peripheral nerves. Recently, however, the prevailing view has been that the disease is caused by bacteria, though the specific bacterium of the disease has not been recognized. Indeed, it is possible that several dissimilar varieties of bacteria may have a similar effect on the tissues of the joints.

German authors still maintain that some few cases are dependent on a true rheumatic infection and develop in direct continuation of an acute rheumatic disease. For such cases Bäumler proposes to reserve the denomination "chronic rheumatism of the joints"; but he admits that they are of rare occurrence; and other authors, including

myself, have never observed any case in which the affection was proved to have commenced with an attack of acute articular rheumatism. The second group of cases, representing an overwhelming majority and recognized by German authors as "polyarthritis deformans" (identical with the rheumatoid arthritis or rheumatic gout of the English and American authors) is, by general consent, attributed to the invasion of a specific bacterium. This view is supported by much evidence: the disease begins in one or a few joints and spreads from there not only to other joints, but also to the nerves, the heart, the muscles, and the skin. It often occurs as a continuation of other infectious diseases, such as influenza, tonsillitis, typhoid, etc. Bannatyne notes that in 25 per cent. of all cases there was a history of disease of the female organs of generation and in 20 per cent. catarrh of the gastro-intestinal or respiratory mucous membranes. I have made the same observation; in many cases the patients confidently consider influenza or diseases of the female organs of generation as the cause of the affection; in some cases it had developed in direct continuation of puerperal affections.

All authors agree that cold and damp rooms, especially when used as sleeping-chambers, are predisposing to the development of rheumatoid arthritis; these conditions certainly favor the development of micro-organisms and their invasion into the body.

Of the predisposing causes, heredity is frequently observed. Women are much more liable to the disease than men. Age is of importance, most cases commencing between the ages of 40 and 50 years, but the disease may occur earlier and even children may be affected by it. In women puberty and the cli-

macteric are particularly liable to the affection.

Many authors have tried to isolate the microbes of rheumatoid arthritis, and in many instances they have succeeded in cultivating bacteria from material taken from the affected joints. Unfortunately, however, they do not agree in the description of the micro-organisms, and have not been able to reproduce the disease in animals.

Bannatyne and Wohlmann cultivated from the synovia taken from diseased joints a dumb-bell-shaped bacillus, resembling in many cases a diplococcus, as the ends of it were deeply stained by carbol-fuchsin and other coloring matters, whereas the connective portion was not at all stained; the bacillus was aerobic, grew on blood-serum, agar-agar, and in beef-bouillon. Blaxall found the same bacillus in the blood of the patients, but in small amount.

Schüller in 1893 described a bacillus cultivated from the synovia of the affected joints, but his description of it, its manner of development, etc., make it obvious that it is not identical with that observed by Bannatyne.

Small diplococci which stained by Gram's method isolated from the exudate in the joints of a case dying after presenting clinical picture of extreme arthritis deformans. The organism grew in all media, but did not develop quickly. Similar micro-organisms were obtained from the liver; the injection of cultures of this diplococcus into the knee-joints of rabbits gave rise to a process similar to rheumatoid arthritis. Von Dengun and Schneider (Münch. med. Woch., Oct. 25, '98).

Rheumatoid arthritis in the majority of instances appears to be a primary malady with characteristic features from the onset. Infrequently the patient suffering from this form of arthritis has previously been affected with acute rheumatism. From a clinical and

pathological standpoint there is still much room for the accumulation of facts bearing upon rheumatoid arthritis, and for the present we should take an expectant attitude in this matter. A. E. Garrod (*Lancet*, March 16, 1901).

From all these experiences it seems demonstrated that micro-organisms are constantly found in the synovia of the diseased joints, but until further experience their significance and mode of action remain uncertain.

Pathology.—In the affected joints there is generally some increase of the synovia, especially in the earlier stages of the disease. The synovial membrane is thickened; in the acute stage is injected and soft, in the chronic stage hard and dense. The ligaments are affected in the same way and in chronic cases often present patches of cartilage; sometimes the patches inserted in the ligaments have a bony basis, while the surface consists of cartilage. The synovial membrane is injected and granular and readily breaks down on pressure, the villi being thickened and more prominent than usual. Small erosions may be found on the cartilage, which presents a velvety appearance. The cartilage ordinarily shows erosions and disappearance of the central tissue, with formation of new cartilage in the periphery. The erosions may be such as to expose the heads, while the proliferation may give rise to the formation of marginal overgrowths. The bones also become much changed, being at first red and injected, soft, and easily broken down. Later on it becomes hard, white, and eburnated. When the bone is exposed, it shows grooves and striæ corresponding to the eminences of the opposing articulating surface. Osteophytes are a very common occurrence, bone being formed as well from the cartilage

and from the ligaments as from the bone itself. In the cavity of the joints free bodies are often found, formed sometimes by coagulated fibrin or consisting of cartilage or cartilage and bone. These, in most cases, arise from the fringes of the cartilage or have been formed in the ligaments, as mentioned above. In rare cases osteophytes are detached by traumatism and thus form free bodies. By the retraction of the new-formed connective tissue and the changes in all the component parts of the articulations, ankylosis is often caused; but true bony ankylosis is a very rare occurrence.

In the muscles decoloration of the fibres and decrease of the volume of each muscle-fibre is found, whereas the number of the fibres is not diminished.

Heberden's knots are small, rounded growths arising from the phalanges of the fingers, commonly from the third, sometimes from the second; they consist of bony tissue and are covered by a projection of the synovial membrane; they are most frequently found in elderly individuals, but have also been noticed at the age of 40 or 50; they are of frequent occurrence in rheumatoid arthritis, but authors of much experience declare having also observed them in cases of true gout. Neuritis and perineuritis, with the infiltration of small round cells in the nerve-sheaths, have repeatedly been observed.

The red corpuscles of the blood are diminished in number, the hæmoglobin shows a marked diminution, and there is a slight augmentation of the white corpuscles.

Prognosis.—The prognosis is rather good as regards life; but ordinarily the disease assumes a very chronic course, and it has hitherto been most rebellious to treatment, ankylosis of the affected

joints being almost certain. When this affects many joints, the patient is reduced to immobility. Of late the prospects of cure have become somewhat more hopeful, especially when modern treatment is applied at an early stage of the disease, before the pathological changes in the joints and the atrophy of the muscles have progressed too far.

Treatment.—The diet, as a rule, is to be nutritious and easily digestible; when fever is present suitable liquid nourishment must be given; all the normal constituents of the food are to be represented in sufficient amount; in many cases codliver-oil is indicated. Stimulants are not so pernicious in rheumatoid arthritis as in gout, and may be permitted if necessary. The patients must be directed not to make few and large meals, but to take food often and at regular intervals.

Woolen garments and blankets are very useful, and the patients are to be directed to avoid chills and exposure to dampness and cold. When possible, the sufferer ought to take such exercise as his forces and the state of his joints will permit; the use of pulleys, massage, and passive and active gymnastics are very useful.

In the few cases which occur as a result of acute articular rheumatism salicylic acid and its compounds—salol, salophen, etc.—will be found useful. When these fail, iodine, iodide of potassium, and tinctura colchici are to be tried; the affected joints are to be painted with iodine or enveloped in gauze saturated with methyl-salicylate.

In cases of true rheumatoid arthritis the therapeutics are to be directed principally against the infection by microbes and the toxins secreted by them. Remedies capable of strengthening the forces and the vital energy of the patient are

necessary. As powerful antidotes against bacterial invasion, the creasotes, naphthols, and phenols are valuable; of the drugs belonging to this group Bannatyne prefers creasotal, and most of all the guaiacol-carbonate. Creasotal is a thick fluid, soluble in alcohol, but not in water; it has an oily taste and a rather disagreeable odor, and is given in the dose of 5 or 8 drops thrice a day. Guaiacol-carbonate—a white, crystalline, insoluble, tasteless and odorless powder, which in the bowels is decomposed, yielding guaiacol—is also valuable; it is given in doses of from 5 to 8 grains three to six times a day. The use of the drug ought to be continued for a long time and gives excellent results; it alleviates the pain and combats the morbid process itself. Benzozol (benzoyl-guaiacol) may also be tried.

For external use a host of drugs have been employed to produce irritation of the skin, turpentine, iodine, camphor, and ammonia, for instance. To relieve the pain, chloroform, belladonna ointments, methyl-salicylate, etc., have also been tried. Bannatyne advocates the external use of guaiacol in combination with an equal amount of olive-oil or combined with tincture of iodine (6 parts of guaiacol to 1 part of iodine); the odor of guaiacol can be masked by a few drops of the oil of cloves. The mixture is painted on the affected joint and covered with a dry dressing.

Electrical treatment has been advised, but is not so useful in this disease as in gout. I have tried the dielectric introduction of lithia with a strong galvanic current in many cases, but I do not consider it to be of much value against rheumatoid arthritis. Steavenson and Garrod employ an electric bath, through which a strong galvanic current of 50 to 200 milliampères is allowed to pass

for about ten minutes; as many patients are very sensitive to galvanic currents of this force, much circumspection is advisable in the use of this treatment.

Thermal treatment has been employed for centuries and until recently the current therapy of rheumatic gout consisted principally in advising a cure in alkaline, sulphurous, or in different springs (Bath, Aachen, Wildbad, etc.), and certainly many patients have profited from such a course. Of late the application of hot-air baths has somewhat supplanted the use of water-baths. The apparatus constructed by Tallermann, Betz, Gréville, and many other inventors make it possible to place the affected limb in a hot-air bath at a temperature of 80° to 120° or even 150° C. This bath may be given daily, if the forces of the patient allow it; they produce a very strong perspiration of the part in treatment, and, although more moderately, of the whole body. The bath is very well borne by the patients, their temperature is only slightly raised by it, while the heart is not at all influenced. These baths are of great value to alleviate the pain and to combat the swelling and the stiffness of the joints.

The local, hot, dry-air bath is of little value in rheumatoid arthritis; but it is of great service in the treatment of ligamentous inflammations and in tenosynovitis, whether rheumatic or of traumatic origin. The temperature considered of most value was the one ranging between 270° and 320° F. H. C. Wood (Med. News, July 17, '97).

In Germany competent observers have advocated a surgical treatment of the disease. Schüller treats the affected joints by repeated injections of a mixture of iodoform, 20 parts; acid-free glycerin, 250 to 400 parts; and guaiacol, 5 parts. The injection is made with every antiseptic precaution. As a rule,

the pain continues for some days, but fever only exceptionally results. Twenty-seven cases were treated in this manner; of these sixteen recovered almost completely. But the cure is more rapidly effected by incision of the affected joint, removal of the diseased synovial membrane and the villous mass, and suturing of the wound with injection of the above-mentioned mixture in the articulation. The joint is kept immovable for ten days and extended by a bandage. After that the sutures and the bandage are removed and massage, electricity, inunctions, and baths are employed. By this method Schüller obtained a complete cure with absolutely normal moveable joints.

In joint rheumatism the following application is excellent:—

R Menthol., 1 drachm.
Ac. salicylici, 2 drachms.
Methyl salicylatis, 1 drachm.
Alcohol., q. s. ad 1 ounce.

Paint joints briskly with camel's-hair brush, cover with absorbent cotton and oiled silk, and bandage snugly, but not tightly.

So efficient has the above combination proved in personal hands that in by far the great majority of cases of acute articular rheumatism it has been possible to dispense with internal medicines altogether. The salicylic acid and methyl salicylate are rapidly absorbed and their presence can be demonstrated in the urine. In this way one is enabled to saturate the system with salicylates without disturbing the gastric function. After a few applications the epidermis begins to peel off and the surface becomes tender. When this occurs the application should be stopped for a day or two and an emollient ointment should take its place. The menthol-salicylate-alcohol application is useful in acute rheumatism only. In the subacute variety its efficiency is very slight, while in chronic rheumatism it is practically *nil*. In the latter two varieties the best results are obtained from a 33-per-cent.

ichthyol ointment or a 20-per-cent. ichthyol-glycerin solution, aided by the persistent and long-continued internal administration of ichthyol and potassium iodide. W. J. Robinson (*Merck's Archives*, April, 1902).

Better results in the treatment of acute and chronic articular rheumatism have been obtained from the use of anti-streptococcus serum than from any other medicine. Chronic cases, if not cured, are materially improved and in acute cases an endocarditis will heal more readily. As proof of the latter fact a case is cited which presented well-marked increase in cardiac dullness with presystolic and systolic murmurs at the apex during an acute attack, but two years after treatment there were no longer any definite signs of endocarditis. Since the serum may render chronic inflammatory processes acute, it should be used with caution in pericarditis, or marked pleurisy, or advanced mitral stenosis. In acute cases single doses of 5 c.c. should be employed, while, if chronic, several periods of treatment are necessary. The other measures employed for rheumatism are also in place, but salicylates need not be given. D. Menzer (*Münch. med. Wochen.*, Aug. 16, 1904).

Muscular Rheumatism.

Definition.—A rheumatic affection of the muscles, causing pain and stiffness of the diseased muscles, which usually disappears after some days. It sometimes assumes chronicity, being then accompanied by the formation of fibrous bands and nodules in the muscles.

Symptoms.—The principal symptom is pain, which may be spontaneous or caused by movements or pressure of the diseased parts. The pain in some cases is limited to the first muscles affected, but sometimes it suddenly disappears from these and attacks another group of muscles. Fever sometimes attends the disease. The symptoms vary according to the muscles affected. In rheumatism of the intercostal muscles breathing

is painful and the disease may be confounded with pleurisy. When the muscles of the abdominal wall are affected, there is excessive tenderness to pressure and the symptoms may resemble those of acute peritonitis; but the absence of fever is of great value as a diagnostic sign. Rheumatism of the muscles of the back occasionally gives rise to opisthotonos, and suspicion of spinal meningitis may arise. Rheumatism of the muscles of the neck causes stiffness, and, when the muscles of one side only are affected, rheumatic torticollis is produced.

In twelve cases of alleged rheumatic wryneck not one was really due to rheumatism. The abnormal position was not caused by pathological contraction of the sterno-cleido-mastoid, but was primary and was assumed to lessen pain; the muscle contracture was secondary and due to position. The pain and tenderness were in all cases on the convex side and not closely related to the muscles. Tenderness was especially elicited over the fourth upper spinous processes. In every instance the lateral flexion of the rigidly-held head could be increased without pain. None of the muscles of the concave side showed increased tonus. Pain was not caused by visible extension of the neck; hence spasm was not the cause of the torticollis. It was evident that the joints of the convex side of the cervical spine were diseased, or that the roots of the nerves passing out at this side were affected.

Two hundred cases of lumbago were observed. In not one was muscular disease noted. In 119 cases there was affection of the articulations of the lumbar vertebræ characterized by tenderness to pressure over the joints, limitation of lateral flexion and lateral curvature, the concavity of this curvature being toward the sound side. Twenty-one cases were instances of neuralgia of the cutaneous nerves which have their origin in the three lower lumbar branches. The region of the vertebral articulations was not tender. Some were alcoholics, some were beginning tabetics, and one was

suffering from osteomalacia. Erben (Centralb. f. Chir., Sept. 10, '98).

The acute form of muscular rheumatism passes away in a few days; the chronic form may continue for weeks and months and often provokes formation of new connective tissue, with its consequence: stiffening of the muscles and contractures. Sometimes small fibrous bands and nodules are formed in the muscles and give rise to much pain and tenderness. Rheumatism of the muscles is in some cases complicated with myositis, which may be general or localized,—limited, for instance, to the muscle of the heart.

Etiology.—Overwork, especially when combined with exposure to cold and dampness, has always been considered as the common cause of the rheumatism of the muscles. Many persons are very sensible to draughts. The disease commonly occurs after the thirtieth year, but is also found before that age. Some individuals have a special predisposition to the disease, and it is very liable to recur in the muscles which once have been affected by it; especially in the muscles of the neck.

In all probability the muscular form of rheumatism is also caused by microbes, but their presence in the affected muscles has as yet not been proved by direct observation.

From observations of two hundred cases of muscular rheumatism, it is concluded that both muscular and articular rheumatisms are infectious and probably caused by an attenuated form of micro-organism. W. Leube (Deut. med. Woch., Jan. 4, '94).

The entrance of a particular attenuated pyogenic organism, invading the tissues through the tonsils, may be the common cause of simple catarrhal angina, or articular and muscular rheumatism, and of the cutaneous manifestation observed in the course of these af-

fections. In addition, many other influences are in action, such as constitutional peculiarity and bad hygienic conditions. The difference in the particular symptom which may arise depends, on the one hand, upon the virulence, more or less marked, of the organism, and, on the other, upon the resistance offered by the structures. Peltessohn (Archiv f. Laryn., etc., vol. vii, Tome v, '97).

Treatment.—For internal use salicylic acid and its compounds are much employed and will sometimes, but not in all cases, bring relief. When the salicylates fail to effect a cure, tincture of colchicum or iodide of potassium may be tried. Externally tincture of iodine and all the rubefacientia—ammonia, camphor, turpentine, etc.—are to be tried; also warmth in the form of hot water, poultices, and hot baths (Russian or Turkish). Of late hot-air baths have been much recommended. The external use of methyl-salicylate often alleviates the pain.

When the disease has passed over to the chronic stage massage and electricity are useful. In cases attended by induration and fibrous nodules in the muscles, characterized often by continuous and very intense pain, excision of the hard nodules of fibrous tissue often gives immediate relief.

Massage recommended in muscular rheumatism. Recent cases are almost invariably cured by a few massages, while in more chronic cases relief will be hastened by the addition of rest, warmth, and electricity. Douglas Graham (Amer. Jour. of Med. Sci., Aug., '93).

Injections of sodium iodate given in a single injection of 7½ to 15 grains, introduced at the site of pain in the form of a 5-per-cent. solution, is usually followed by prompt relief. Care should be taken to have both salt and solution as fresh as possible to avoid free iodine irritation. S. Otto (Ther. Monats., Apr., 1900).

Gonorrhœal Rheumatism.

Definition. — An acute inflammation of one or more articulations occurring during the course of gonorrhœa and caused by invasion of gonococci in the joints.

Symptoms.—Gonorrhœal rheumatism ordinarily appears in the acute stage of the gonorrhœa. In some cases the lesion of the joints is only revealed by arthralgia: *i.e.*, intense pain without swelling. This affection is particularly observed in the small articulations of the foot. The pain is worst in the evening and is aggravated by movements. The arthralgia may also precede the evolution of the gonorrhœal arthritis or continue for some time after the disappearance of the swelling.

In other cases the affected joint becomes the seat of an effusion of fluid, giving rise to no pain or accompanied by very little pain. This effusion disappears very slowly and often leaves a stiffness or fibrous adhesions in the joint. This form of the disease is most frequently observed in the knee.

Ordinarily gonorrhœal rheumatism in its mode of invasion and evolution resembles very much the acute form of articular rheumatism. It differs from that disease by attacking only one or a few articulations at the same time; the affected joints remain involved for a longer time. Again, gonorrhœal arthritis does not migrate so suddenly from one joint to another as the acute articular variety. No joint, however, is immune, and even those which ordinarily escape during the course of rheumatic fever, as, for instance, the articulations of the jaws and the neck, may be attacked by the gonorrhœal arthritis.

The pain is of extreme intensity. It is aggravated by movements and by pressure over the swelled articulation.

Many painful points are also found. The tumefaction is ordinarily very marked; it is caused as well by effusion into the joint and by œdema of the overlying coverings. The skin over the affected joint is hot and tense.

Commonly the patient tries to alleviate the pain by keeping the affected joint semiflexed. If he is allowed to remain in this position, contraction of the extremity may result.

Gonorrhœal rheumatism does not affect the articulations alone. The serous bursæ and the sheaths of the tendons in the proximity of the diseased joint are always involved; sometimes they alone suffer. The muscles of the affected extremity are always affected and generally become atrophied.

In some cases one joint only is attacked; the pain is, then, as a rule, still more excruciating and the effusion greater than in the polyarticular form.

The acute stage of the disease is not, usually, of long duration. After some days or a week the pain declines and the effusion diminishes. The disease rarely disappears completely, however; one or more joints remain somewhat stiff and painful several months.

Suppuration of the joints affected by gonorrhœal rheumatism is a rare occurrence. It only happens when the infection with gonococci is complicated with the invasion of pyogenic microbes. The chronic form of gonorrhœal rheumatism often gives rise to contracture of the joints or periostitis of the epiphyses.

Diagnosis. — The diagnosis is easy when the urethral discharge is still present, but difficult when it is not. The disease may be confounded with acute articular rheumatism and with osteomyelitis. In gonorrhœal rheumatism only few articulations are attacked at once. The development of the arthritis, the

inefficacy of the salicylates, and, if possible, the demonstration of gonococci in the affected joint constitute the main distinctive signs.

Etiology—Gonorrhœal rheumatism is caused by an infection with gonococci, and it is only observed as the consequence of a gonorrhœal blennorrhagia. Many authors have found the gonococci in material taken from the affected joints or synovial sheaths, and some have even observed them in the blood of the patients. The disease attacks both sexes equally; it may occur in children as well as in adults.

Blood taken from five individuals suffering from gonorrhœal rheumatism and all having gonococci in their urethral discharge. From these specimens cultures were made; in three cases the result was negative, but in two bacteria were found having all the characteristics of gonococci and producing a characteristic discharge upon being introduced in the vagina of a bitch. Hewes (Boston Med. and Surg. Jour., Nov., '94).

Out of 48 cases of gonorrhœal arthritis, only 6 were women. The average age was thirty years. Only 3 had a decidedly rheumatic history. These cases seemed to show that arthritis is as liable to follow a mild attack as a severe one. James Stewart (Montreal Med. Jour., Mar., 1900).

Acute gonorrhœal arthritis, which may be multiple, but is more often mono-articular, is caused by the gonococcus and staphylococcus. Septic arthritis, puerperal or otherwise, of streptococcic infection, is generally purulent. The secondary multiple arthritis of acute infectious diseases can be easily differentiated. Multiple neuritis concerning the upper and lower limbs resembles acute rheumatism. Acute osteomyelitis and necrosis of bone may be multiple and mistaken for the above disease. Gout and acute rheumatism will not be easily confounded. Leonard Weber (Medical News, Aug. 23, 1902).

Prognosis.—The prognosis as to life is good, very often the disease results in

stiffness of the affected joint and weakness of the limb, caused by atrophy of its muscles.

Treatment.—The treatment with drugs given internally is not of great value; the salicylates have no influence on the course of the affection.

Oil of gaultheria is of value in both acute and subacute stages of gonorrhœal rheumatism and comes the nearest to a specific of any of the many remedies used. It may be given in doses of from 5 to 20 drops every two hours in milk. Ichthyol ointment also recommended as a local application. Ramón Guitéras (N. Y. Med. Jour., Mar. 24, '94).

Proper treatment of gonorrhœal rheumatism consists in treating the discharge itself. The gonococci must be destroyed at their point of origin, where they multiply and infect the organism generally. The best means is by permanganate-of-potash irrigations. The treatment is more effective in early cases; but if the joints have been affected for long, it often fails. In such obstinate cases the joints may be injected with 1 in 4000 perchloride of mercury. In suppurating cases arthrotomy is indicated. Rendu (La Méd. Mod., No. 102, '96).

In the treatment of gonorrhœal rheumatism every means should be exhausted for the purpose of shortening the attack of gonorrhœa. So far as internal treatment is concerned, large doses of from 45 to 60 grains of salicylate of sodium combined with one of the balsams are useful. In the chronic cases iodide of potassium often does good. The local treatment consists in immobilization of the limb, the application of ice-bags upon the painful part, and the application of soothing ointments which also possess a resolvent influence. The following may be used:—

R Salicylic acid,
Oil of turpentine,
Lanolin, of each, 2½ drachms.
Lard, 3 ounces.

In chronic cases counter-irritation, massage, electricity, and turpentine-baths are to be used, and the patient recommended to resort to some hot

springs. Should there be considerable effusion into the joint, compression may be used for its absorption, or, if the effusion becomes purulent, it should be carefully aspirated, and by means of the same needle 60 to 90 minims of a 1 to 4000 solution of corrosive sublimate should be injected. Should the articular inflammation become exceedingly severe, an arthrotomy is indicated. Balzer (*Jour. des Prat.*, Apr. 11, '96).

Syrup of ferrous iodide recommended in gonorrhœal rheumatism, the initial dose being 30 drops, three or four times a day, gradually increased, if necessary, drop by drop, until 1 drachm is given. Rapid improvement follows in most cases. J. C. Wilson (*Penna. Med. Jour.*, Sept., 1900).

The diseased extremity is to be secured in a proper position, and the pain may be alleviated by poultices, the use of narcotics, ointments of ichthyol, belladonna, etc. When the acute pain has subsided, compression is useful, and after some time the mobility is to be restored by massage, passive gymnastics, baths,—especially hot-air baths,—etc.

The best treatment for gonorrhœal rheumatism is wrapping the joint with a cloth saturated with a solution of bichloride of mercury, 4 grains to the ounce, and surrounding the cloth with oiled silk. Rapid recoveries claimed without internal treatment. C. B. Hutchins (*Med. World*, Jan., '93).

It is advisable in all acute inflammations of the joints to examine the urethra. In 90 per cent. of the cases urethritis will be found. The cases may be divided into four groups: first, where effusion alone occurs; second, where there is formation of fibrin and thickening of the capsule; third, periarticular phlegmon, with impairment of the action of the tendons and elasticity of the ligaments; fourth, where ankylosis occurs very early. Puncture of the joints and the injection of a solution of carbolic acid advised. If there is a periarticular affection, the joint should be opened and washed out. König (*Samml.*

klin. Vort., No. 70, '96; *Boston Med. and Surg. Jour.*, July 7, '98).

The writer, with Pinkmey and Balzer, recommends the local action of turpentine bath in gonorrhœal rheumatism. The baths may be local or general, and the formula used is aqueous emulsion of black soap, essence of turpentine, equal parts, mixed in a mortar till about the thickness of treacle. For a local bath, 20 to 25 grammes of the mixture are used with 25 litres of water. The genital organs and skin may be reddened and swollen after the bath, and should be rubbed with vaselin previously. The pain is much relieved for several hours after the bath, which should last about half an hour. Gaucher (*Revue Prat. des Mal. des Organes Génito-Urin.*, May 1, 1904).

Surgical measures—aspiration, early incision into the joint—have given rise to excellent results. In twenty cases treated by Brès an incision was made into the joint, the diseased synovial membrane was removed, and dilute tincture of iodine or a weak solution of chloride of zinc was injected. All his cases recovered completely.

Case of gonorrhœal arthritis in which incision was made over the outer edge of the patella, the capsule of the knee-joint was reached by dissection, and 10 ounces of thin, brownish, sero-purulent fluid were evacuated. The cavity was explored with the finger, and several fibrinous flakes turned out; it was then thoroughly flushed with normal salt solution. Sterile wicks were passed through and the cavity again washed out. After the second douching the wound was closed and a dry dressing, with compression, was applied and the limb placed on a ham-splint. The patient was dismissed cured in seventeen days. Homans (*Boston Med. and Surg. Jour.*, Dec. 29, '98).

F. LEVISON,
Copenhagen.

RHINITIS. See NASAL CAVITIES.

RHUBARB.—Rhubarb, or rheum (U. S. P.), is the root of *Rheum officinale* and of other undetermined species of *Rheum* (nat. ord., *Polygonaceæ*): a plant indigenous to Asia (China, India, Tartary, and Thibet), but which is cultivated in America and elsewhere. It contains extractive, sugar, starch, pectin, lignin, salts, several unimportant alkaloids, a glucoside, and acids, one of which, chrysophanic acid is used in medicine. In commerce two sorts are recognized,—the Chinese and the European,—the former of which is considered the better. It occurs in irregular cylindrical or conical, flattened pieces, which are generally perforated, are covered with a light-yellowish-brown powder, and have frequently a wrinkled surface. Beneath the powder the color of the root is reddish brown, mottled with lighter hues. The root is dense and hard and has a bitter and somewhat astringent taste and a peculiar aromatic odor. When chewed, the root is gritty (due to the presence of crystals of calcium oxalate), and imparts a yellow color to the saliva. European rhubarb is inferior to the Chinese variety; powdered rhubarb is also inferior, and, if not adulterated, at least is generally made up of inferior, damaged, worthless, or worm-eaten material.

Preparations and Doses.—Rheum, U. S. P. (the root), 5 to 30 grains.

Extractum rhei (U. S. P.), 5 to 15 grains.

Extractum rhei fluidum (U. S. P.), $\frac{1}{4}$ to 1 drachm.

Mistura rhei et sodæ, U. S. P. (fluid extract of rhubarb, 15; fluid extract of ipecac, 3; bicarbonate of soda, 35; glycerin, 350; spirit of peppermint, 35; water, sufficient to make 1000 parts), $\frac{1}{2}$ to 2 ounces.

Pilulæ rhei, U. S. P. (rhubarb, 3 grains), 1 to 5 pills.

Pilulæ rhei compositæ, U. S. P. (rhubarb, 2 grains; aloes, $1\frac{1}{2}$ grains; myrrh, 1 grain), 1 to 3 pills.

Pulvis rhei compositus, U. S. P. (Gregory's powder: rhubarb, 25; magnesia, 65; ginger, 10 parts), 1 to 3 drachms.

Syrupus rhei, U. S. P. (fluid extract of rhubarb, 10 per cent.), 2 to 6 drachms.

Syrupus rhei aromaticus, U. S. P. (aromatic tincture of rhubarb, 15 per cent.), 2 to 6 drachms.

Tinctura rhei (U. S. P.), 1 to 4 drachms.

Tinctura rhei aromatica (U. S. P.), $\frac{1}{2}$ to 3 drachms.

Tinctura rhei dulcis (U. S. P.), 1 to 2 drachms.

Poisoning by Rhubarb.—Rhubarb is not generally considered poisonous, but a case has been reported in which the internal administration of rhubarb gave rise to an hæmorrhagic eruption of macules, pustules, and blebs. The mucous membranes were also affected, and free hæmorrhage from the urethra occurred.

Therapeutics.—Rhubarb is an excellent stomachic tonic in atonic dyspepsia associated with deficient biliary and intestinal secretion. It is a remedy especially adapted to those of relaxed habit, but inadmissible when an hyperæmia of the mucous membrane exists (Bartholow).

Rhubarb is a valuable remedy in simple constipation, where we wish to unload the bowels without affecting the general system. The root is often chewed by adults to relieve constipation. In children the syrup is a palatable preparation for this purpose; the pill or compound pill may be used by adults.

Constipation and hæmorrhoids depending upon pregnancy are benefited by the administration of rhubarb.

Syrup of rhubarb precipitates ergotine, no matter by what process the ergotine

has been prepared. This is owed to the tannin contained in the rhubarb. Editorial (Jour. de Pharm. d'Anvers; Settimana Med., Mar. 25, '99).

In the summer diarrhœa of children, with green stools, the aromatic syrup of rhubarb may be employed to empty the bowel of its fermenting contents before giving direct treatment. The diarrhœa of indigestion in children and adults is relieved by the aromatic syrup or by the mixture of rhubarb and soda.

In children when constipation is replaced by diarrhœa if any ordinary laxative is used, rhubarb is an available remedy on account of its secondary astringent action.

Functional disturbance of the liver with deficient biliary secretion is relieved by the administration of rhubarb, either alone or, better, combined with blue mass.

Rhubarb is an efficient remedy in duodenal catarrh and in catarrh of the biliary ducts with jaundice, especially in children. White, pasty, or clay-colored stools with a skin of an earthy or jaundiced hue are indications for rhubarb.

RUBELLA.—Latin, *rubellus*, reddish.

Synonyms.—Rötheln, German measles.

Definition.—Rubella is an acute, infectious, contagious disease of mild character, presenting somewhat variable symptoms and running a favorable course. Its identity as a disease, *sui generis*, was long doubted. There is now no question, however, that it is a distinct entity among diseases, though it strongly resembles in its different manifestations measles and scarlet fever. No better statement of present beliefs regarding its true character has been made than that of Griffith, which is as follows: "(1) rubella is a contagious, eruptive fever, and not a simple affection of the skin; (2) it prevails in-

dependently either of measles or of scarlet fever; (3) its incubation, eruption, invasion, and symptoms differ materially from both of these diseases; (4) it attacks indiscriminately and with equal severity those who have had measles and scarlet fever and those who have not, nor does it protect in any degree against either of them; (5) it never produces anything but rubella in those exposed to its contagion; (6) it occurs but once in the individual."

Period of Incubation.—The period of incubation given by different authors is as follows: Holt, 8 to 16 days, the limits being 5 to 22 days; Rotch, 21 days; Edwards, 7 to 14 days; Plant, 1 to 3 weeks; Smith, about 2 weeks. These figures clearly show that the period of incubation is of considerable length and extremely variable. The indefiniteness arises not so much from lack of observation as from variability in the disease. To say that the period of incubation is about two weeks is probably as correct and definite a statement as can be made.

Symptoms.—The symptoms of rubella are extremely variable, so much so in fact that we must agree with Rotch that it is impossible to describe a typical case in such a way that the disease can be certainly diagnosed in a sporadic case. Many cases, however, run a fairly consistent and characteristic course. The invasion is seldom severe. In some cases there is a prodromal stage lasting a few hours; in others the rash is the first symptom to be observed. The fever is rarely high and often does not rise above 100°, but commonly, when at its height, on the first day of the eruption, it reaches 101° or 102°. It occasionally rises to 104° or more. The drowsiness, stupor, and other evidences of serious illness so frequently seen at the height of measles are rarely, if ever, seen in rubella. A child with a bright and very extensive

eruption will frequently show no sign of general illness.

The apyrexia which so commonly attends rubella is an altogether-exceptional phenomenon in measles. If, then, a child affected with a measly eruption is apyretic, rubella may be almost certainly diagnosed. Juhel-Rénoy (*Lancet*, Nov. 11, '93).

In my own experience, sore throat has been the rule. The tonsils and pharynx are red and swelled and there is pain on swallowing. This is occasionally so marked as to be very suggestive of scarlet fever. The vomiting so common at the outset of that disease, however, is rarely present. A secondary sore throat which comes on as the disease is subsiding was first noted by Eustice Smith as very characteristic of rubella. It certainly occurs in some cases. The symptoms of the primary angina subside on the second or third day and rapidly disappear. There are no catarrhal symptoms in most cases, but occasionally slight suffusion of the eyes and a mild catarrh will render the diagnosis from measles more difficult.

Enlargement of the post-cervical and suboccipital glands is a very constant and very characteristic symptom of rubella. Numerous small glands may almost invariably be felt behind the sterno-mastoid well down toward the shoulder; they rarely become very large and never suppurate. They may be felt most distinctly when the rash is at its height, and disappear rapidly. While they aid materially in diagnosis, and may perhaps be called diagnostic, they are certainly not pathognomonic, for they may sometimes be found in measles and in rare cases may be found in scrofulous children without febrile symptoms.

There is one pathognomonic feature eminently distinctive of rubella. It is an enlargement of the small glands just at the edge of the hair on the postero-

lateral sides of the neck. This feature has never been absent in any case coming under personal observation. Osborn (*Weekly Med. Review*, Dec. 24, '87).

Experience recorded in three epidemics of rubella. The cases in the first were almost all typical—the eruption, the fever, the enlarged post-cervical glands, and the slight indisposition presenting an array of symptoms pathognomonic of rubella. In the second epidemic there was a close resemblance to measles. The catarrhal symptoms and eruption were very much like measles. The third epidemic closely resembled scarlet fever. J. R. Hillsman (*Memphis Med. Monthly*, Sept., '92).

Though regarding cervical adenitis as almost pathognomonic of rubella, it was noted in an epidemic of measles in 1886 that 24 out of 27 cases exhibited a glandular enlargement exactly similar to it. Swift (*"Reference Hand-book of the Med. Sci.," '92*).

The pigmented spots seen in true measles never seen; nor the rose-red spots with the bluish-white speck in the centre seen in measles. The buccal mucous membrane in most cases of *rötheln* is of a normal pale-pink hue. The temperature is highest at the outset, when the eruption has appeared on the face. Enlargement of the lymph-nodes behind the sterno-mastoid muscle personally observed. Generally, the tonsils are enlarged. In varicella the spleen is sometimes palpably enlarged, but not in *rötheln*. Scarlet fever does not affect the face so distinctly. The punctate spots in scarlet fever have no particular arrangement; in *rötheln*, if the papules are as small as those of scarlet fever the skin between the papules has a normal color. The exanthem of measles of the discrete type closely resembles that of *rötheln*. The buccal mucous membrane then becomes the crucial test. The highest temperature reached is 103° F. Henry Koplik (*Jour. Amer. Med. Assoc.*, Nov. 10, 1900).

The eruption appears first upon the face or forehead and extends rapidly over the neck, trunk, and limbs. The whole body is usually covered within

twenty-four hours. Occasionally the child will wake in the morning with a rash covering the greater portion of the body. In many cases the rash is limited

not more than twenty-four hours, but, as a rule, it is present from two to four days. Itching is common at the outset.

A slight scaly desquamation may fol-

Most salient features by which one may distinguish rubella from measles and scarlet fever are as follow:—

	RUBELLA.	MEASLES.	SCARLET FEVER.
<i>Invasion</i>	<i>Nil.</i>	Three to five days, with pyrexia and conjunctival and bronchial catarrh.	Twelve to twenty-four hours, pyrexia, headache, and vomiting.
<i>Catarrh</i>	Slight or absent.	Marked conjunctivitis, coryza, cough, etc.	Absent.
<i>Eruption</i>	Appears on face and chest as bright, pink-red maculæ, first under the cuticle, which become raised, with tendency to spread and form irregular patches or become diffuse.	Appears on face as darkish-red, slightly-raised papules; extends to trunk and limbs; papules become confluent, but distribution is more uniform.	Appears on chest as diffuse general redness of skin.
<i>Throat-lesions</i>	Slight swelling and injection of fauces.	Fauces injected.	All the faucial structures acutely inflamed, swelled and red, or ulcerated.
<i>Tongue</i>	Furred.	Furred.	Thickly furred, which begins to strip off in twenty-four or forty-eight hours, leaving raw surface, with enlarged papillæ.
<i>Superficial lymphatic glands</i>	Always enlarged in axillæ, groins, and behind sterno-mastoid muscle in neck.	May be enlarged at angles of jaw and behind sterno-mastoid muscle.	May be enlarged at angles of jaw and behind sterno-mastoid muscle.
<i>Desquamation</i>	Absent or very slight.	Branny.	Characteristic peeling off of large pieces of epithelium.

N. S. Manning (Med. Press and Circular, Feb. 18, '91).

to small areas, the greater portion of the body escaping entirely. It is more constant upon the face than any other region. In some cases the rash continues

low the disappearance of the rash, but in many cases no desquamation can be detected. This is particularly true when inunction of the body has been practiced.

The eruption consists of papules or maculo-papules of a red or rose-red color. They vary greatly in size, varying from a pin's-head point to a large blotch. This multiform character is one of the peculiarities of the eruption of rubella. Most of the spots are smaller than those of measles and larger than those of scarlet fever. They vary in size on different portions of the body, and even in the same region the rash will be found, as a rule, to be made up of small dots interspersed with larger and irregular-shaped spots or blotches. It lacks the uniformity of the rash seen in scarlet fever or measles. The rash more commonly resembles that of measles and it is frequently impossible to make a diagnosis from it alone. Edwards has recently alleged that he has not seen the rash resemble that of scarlet fever. That is not my experience. I have frequently seen a rash consisting of small points grouped closely upon a reddened skin that looked extremely like scarlet fever. Search over the body, in such cases, however, will usually reveal small areas of eruption composed of maculo-papules, appearing as large spots. These are commonly found upon the arms, wrists, or hands. I quite agree with those who describe a scarlatinal and a rubeolar type of eruption. I have seen these two types well marked in two children of the same family exposed at the same time, and ill in the same room. The rash of one, consisting of large maculo-papules, very strongly resembled measles; that of the other, consisting of much finer points on a reddened skin, as strongly resembled scarlet fever.

Recurrent roseola shows a tendency to appear along the posterior intercostal spaces, never appearing on the anterior surface of the thorax or abdomen. This has been seen in syphilis. As the eruption is fleeting, all syphilitics were ex-

amined twice weekly. Only eight typical cases were found among 1089 patients. Other varieties of roseola occurred, both circinate and ovoid. This eruption appeared in distinct lines along the intercostal spaces, each spot discrete, the whole resembling the branches of a tree, of which the spine was the trunk. The upper branches were shorter than those lower down. The eruption was visible from one to two weeks, being very distinct only a few days. De Beurmann and Louis Delherm (*Jour. des Praticiens*, April 13, 1901).

Etiology.—Analogy leads to the belief that rubella is caused by a specific micro-organism, but the germ has not yet been discovered. It is contagious, though not as strongly so as scarlet fever and measles. Its contagious power at times seems to be very slight. It is most contagious when the eruption is at its height. It is rarely, if ever, seen under six months, but after that age no period of life is exempt. It is most common between five and ten years. The recurrence of true rubella is rare. The disease usually occurs in epidemics, which are most common in the spring.

Complications and Sequelæ.—No other infectious disease is so free from complications. This is, in fact, one of the most marked peculiarities of rubella. Even varicella sometimes shows a serious complication: that of gangrene. No such serious symptom is likely to arise in rubella. The pneumonia, otitis, erysipelas, and multiple abscesses, which in rare instances have been reported as accompanying rubella, are perhaps not in every case a complication, but rather a coincidence.

Prognosis.—Death from rubella is extremely infrequent. In the rare cases in which it occurs it is usually the result of some pulmonary disease, occurring either as a complication or as a coincidence.

Treatment.—Rubella requires very little, if any, treatment. Mild treatment appropriate to any febrile condition is permissible, but if the patient is kept in bed while the fever and rash continue, and is anointed daily with oil, further treatment will rarely be required. Symptoms must be treated as they arise. In most cases the disease as such is of but little importance, its chief interest lying in its diagnosis, owing to its resemblance to two more serious diseases.

Epidemics of rubella are characterized by successive outbreaks separated the one from the other by an interval corresponding to the period of incubation. The disease is infectious from the beginning, like measles, and isolation of the patients is too late a measure. The *desideratum* is isolation of children who

have been in contact with cases. These exposed persons should be closely watched, especially from the twelfth day after exposure, in order that they may be isolated on the appearance of the initial symptoms. Once the disease is over,—i.e., in about eight days,—the patient is no longer dangerous to his neighbors. Disinfection of the room, furniture, etc., unnecessary, the specific microbe being, like that of measles, endowed with a very limited vitality. Sevestre (Lancet, Nov. 11, '93).

All indications for treatment of rubella are met by a bland diet, rest in bed during three to four days, and a week's confinement to the house. After two weeks the patients may resume attendance at school. Blaschko (Ther. Monats.; Med. News, Jan. 29, '98).

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SALICYLIC ACID AND THE SALICYLATES.

Salicylic acid (ortho-oxy-benzoic acid; acidum salicylicum, U. S. P.) is an organic acid existing naturally in the oils of wintergreen (*Gaultheria procumbens*) and sweet-birch (*Betula lenta*) in combination as methyl-salicylate; its artificial preparation was discovered by Kolbe in 1874, who produced it from carbolic acid, caustic soda, and carbonic-acid gas by the aid of moderate heat, and subsequent treatment with hydrochloric acid. Salicylic acid occurs as a light, fine, white, crystalline powder or as small needles, having no odor and a sweet taste, with acrid after-taste. It is soluble in 2 parts of ether, 2.4 parts of alcohol, 60 parts of cold and 16 parts of warm glycerin, in 80 parts of chloroform, in 14 parts of hot or 450 parts of cold water, in 2 parts of olive-oil (by aid of heat), and in 30 parts of sweet spirit of nitre. Its solubility is increased by

addition of the phosphates, citrates, and acetates of the alkalies and borax. Pure salicylic acid should be free from color and from the odor of phenol, and when heated on platinum foil it should leave no ash.

Preparations and Doses.—Acidum salicylicum (U. S. P.), 10 to 30 grains.

Lithii salicylas (U. S. P.), 10 to 30 grains.

Methyl salicylas, U. S. P. (artificial or synthetic oil of wintergreen), 1 to 10 minims.

Phenyl salicylas (salol, U. S. P.), 3 to 15 grains.

Physostigminæ salicylas, U. S. P. (eserine salicylate), $\frac{1}{100}$ to $\frac{1}{30}$ grain.

Sodii salicylas (U. S. P.), 8 to 60 grains.

Administration.—Salicylic acid should not be administered in pill, powder, or capsule, but always in solution, as it is very irritating to mucous surfaces. It is preferably given with ammonium or

potassium acetate, potassium citrate, or ammonium phosphate, all of which increase its solubility in water, or it may be given in some syrup, flavored with compound spirit of lavender, or in elixir of orange. H. C. Wood suggests an extemporaneous solution of ammonium salicylate made by mixing 1 drachm of salicylic acid and 5 drachms of syrup, adding aqua ammoniæ in sufficient quantity to dissolve the acid, which yields a finished product of about 6 drachms, one teaspoonful representing about 10 grains of the acid. A similar result may be obtained by administering the acid (10 to 15 grains) in a tablespoonful of spirit of Mindererus (liquor ammonii acetatis, U. S. P.). The sodium salicylate (containing 80 per cent. of salicylic acid) or lithium salicylate may be given in a strongly-aromatized syrup. Methyl-salicylate, or artificial oil of wintergreen, or the natural oil of wintergreen may be given in emulsion or in capsule. The tinnitus caused by salicylic acid may be relieved by a 20-grain dose of bromide of sodium. Physostigmine salicylate is not used for the same purposes as the other official salicylates, and will be found under *PHYSOSTIGMA*.

Salicylic acid should not be combined with exalgin, as a reaction takes place between them.

Contra-indications.—The use of salicylic acid and the salicylates is contra-indicated in middle-ear disease, inflammation or congestion of the brain or meninges, albuminuria, and renal disease with impaired function, as in pregnancy and Bright's disease.

Physiological Action.—Salicylic acid has an irritant action upon the mucous membranes. When given to man in medicinal doses it produces symptoms simulating cinchonism: a feeling of fullness in the head, tinnitus aurium, and,

perhaps, slight giddiness. Larger doses may give rise to headaches, partial deafness, mydriasis, amblyopia, or partial blindness. Moderate doses do not seem to affect the respiration or circulation very much. The respiration is somewhat quickened, owing to an irritation of the pulmonary vagi and probably some stimulation of the respiratory centres; after very large doses failure of respiration occurs through a gradual or sudden depression or paralysis of the centres (Wood). Moderate doses seem to increase arterial pressure slightly by exciting the vasomotor centres and directly increase the cardiac force. Very large doses cause a fall of arterial pressure, due, in part, to direct action upon the heart. The action of salicylic acid upon the nervous system appears to be a depression of the motor nervous centres, full doses causing, in addition to the head-symptoms noted above, a diminution of the reflexes and, in large doses, epileptiform convulsions by direct action upon the brain. The action of salicylic acid in medicinal doses upon the normal temperature is variable and slight; if fever be present, its lowering action upon the fever is marked. This latter effect is supposed to be produced by inhibiting heat-production and increasing heat-dissipation, but our knowledge upon this point is far from certain. The first effect of an antipyretic dose in fever is profuse sweating, which may appear within fifteen minutes. Very soon the temperature begins to fall, the depression reaching its maximum in about six hours (Justi). Wood believes that the perspiration can scarcely be the only factor in the reduction of temperature, as there appears to be no relation between its amount and the degree of the fall, and it usually ceases before the latter reaches its maximum. Salicylic acid is absorbed and circulates in the blood,

probably, as sodium salicylate, and is eliminated chiefly through the kidneys, partly unchanged and partly as salicyluric acid, the green discoloration of the urine being due to indican or pyrocatechin. The salicylates increase the elimination of urea and uric acid (Haig). Large doses of salicylic acid produce an irritant effect upon the kidneys. The action of salicylic acid and its salts appears to be identical.

Salicylic acid diminishes the vital activity of protoplasm. It is a specific in acute articular rheumatism and in gout, showing itself by a special action exercised not upon a cause still unknown in its real essence, but on account of the power of the anatomical element to sustain this cause and react under its influence. This, however, does not exclude a true specific action upon a cause still unknown, analogous to that exercised by quinine upon the blood-parasites of paludism or mercury upon syphilis. Besides this specific action, which may be called a special antiseptic, there is a general antiseptic one, which may be useful in variola, diarrhoea, diphtheria, and orchitis after blennorrhagia. M. G. Ponchet (*Nouv. Rem.*, No. 3, p. 57; No. 4, p. 89, '96).

Poisoning by Salicylic Acid.—The symptoms of poisoning by this drug are those of an irritant poison. After the ingestion of a toxic dose nausea follows with a burning sensation in the throat, vomiting, and gastric irritability. There is headache, with great distress in the head and serious disturbances of hearing and vision (deafness, ptosis, strabismus, amblyopia, dilated pupils); excessive restlessness, passing into delirium; slow, laboring pulse; at first accelerated and deepened breathing, with extreme dyspnoea (later feeble and shallow); olive-green urine; occasionally albuminuria, hæmaturia, or even suppression of the urine. Sweating is usually profuse. Local evidences of vasomotor depression may

be present, such as rapidly-appearing bed-sores at points subjected to pressure and transitory dark-colored spots over the body (Wood). Post-mortem examination in a case of death from salicylic acid revealed a breaking-down of the blood, visceral congestion, and ecchymotic spots upon the serous membranes.

Case of a 54-year-old man who had been treated in years preceding for nephritis. Sixty grains of salipyrin were given in four doses. On the next day an eruption appeared upon his scrotum, which became a large, markedly oedematous, infiltrated, red surface. The following day the patient, against advice, repeated the drug. Necrosis of the affected areas followed, and a deep wound-cavity was left which healed under sublimate solutions. The urine showed a notable amount of albumin. Fedor Schmey (*Ther. Monats.*, H. 3, S. 175, '97).

In some cases the mental disturbance persists for a week or more. The acid acts very unfavorably upon drunkards, violent delirium being a common and early symptom (Wood). When death occurs, it is preceded by great dyspnoea and general convulsions, and is due to respiratory paralysis.

Erythema with oedema, intolerable itching and tingling of the skin, and fever have been caused by large doses of the sodium salt. Other observed effects upon the skin are vesicles, pustules, and patches of ecchymosis.

A form of chronic poisoning may occur in persons exposed to inhalation of the acid, which is marked by a subacute inflammation of the air-passages attended by congestion, swelling, and oedema of the mucous membrane. The swelling of the tracheal mucous membrane may be so marked as to cause stenosis. In these cases iodide of potash has been found beneficial.

Treatment of Poisoning by Salicylic Acid.—The treatment for poisoning by

this drug is that for an irritant poison. It will be well to wash out the stomach with warm water and administer strong coffee. Further treatment will be indicated by the symptoms present.

Therapeutics.—Salicylic acid and the salicylates may be used remedially for their antiseptic, antifermentative, antipyretic, antirheumatic, antipruritic, or antihydrotic property.

RHEUMATISM.—As a remedy in acute articular rheumatism, salicylic acid and the salicylates hold first rank by reason of their prompt and uniform relief of the pain, fever, and other symptoms incident to this disease. Several methods of medication are suggested. Ten to 20 grains may be given every hour until 1 drachm is taken, the same dosage being repeated the following day. Fifteen to 20 grains may be given every four hours until marked physiological symptoms appear. Thirty to 40 grains may be given at 7 and 9 P.M., with a glass or two of milk, so that the effects are produced during sleep. An extemporaneous mixture of potassium salicylate may be prepared by dissolving 3 drachms of salicylic acid and 6 drachms of potassium bicarbonate in 2 ounces of cinnamon-water, a teaspoonful of which may be given in a wineglassful of water every two or three hours. Internal medication in this disease may be supplemented by the use of lint wet with a solution of sodium salicylate, wrapped around the rheumatic joint or of an ointment of salicylic acid applied locally, or the joint may be painted with oil of wintergreen or oil of birch. Local absorption of salicylic acid results through the topical use of any of these remedies. After the subsidence of the acute symptoms the salicylates may, with advantage, be replaced by one of the alkalies; the citrate of potash and soda in doses of 30 to 60

grains at bed-time act well in the subacute stage. In chronic rheumatism the salicylates seem to be valueless.

Salicylate of methyl is more particularly successful in the articular manifestations of rheumatism, especially as a means of relieving pain. The amount of urine should be watched during the administration of this drug. Salicylate of methyl is also of extreme advantage in subacute and chronic rheumatism. The drug is also efficacious in neuralgia, sciatica, some forms of neuritis, herpes zoster, and in the lightning pains of tabes. In cases of orchitis from mumps it has been tried with remarkable results. Schoull (*Jour. de Méd.*, Mar. 10, '99).

In muscular rheumatism the salicylates are useful in relieving the pain. The salicylates are of no value in gonorrhœal rheumatism until the gonorrhœa is cured, when the rheumatism usually ceases without treatment. In rheumatoid arthritis the salicylates are useless. Rheumatic iridochoroiditis and scleritis are, however, markedly benefited by 15-grain doses of the salicylates, given four times a day.

GOUT.—The value of the salicylates in gout is not definitely settled. Sée, Jaccoud, Haig, and others recommend them; Dyce Duckworth claims that they are inferior to colchicum. If given at all, large doses seem to be necessary. The salicylates frequently arrest the pain and are said to favor the absorption of the tophi.

In lumbago, sciatica, and similar malades salicylic acid is very useful, especially if they are of rheumatic origin.

NEURALGIA.—In neuralgia the salicylates are not as good as phenacetin and similar remedies. In migraine of rheumatic origin the salicylates will not only relieve, but often effect a cure.

In the nervous irritability of gouty or lithæmic patients Brunton advises the

use of the salicylates combined with the bromides.

The pains of locomotor ataxia and of peripheral neuritis are often relieved by the salicylates.

FEVERS.—The employment of salicylic acid as an antipyretic in fevers has fallen into disuse. Cold baths and other antipyretic remedies have replaced it.

INFLAMMATIONS.—In quinsy or parenchymatous tonsillitis salicylic acid is a specific, especially if of rheumatic origin. If given early it will relieve the pain and swelling, shorten the period of illness, and prevent suppuration; doses of 3 or 4 grains every hour suffice.

The salicylates are useful in the post-inflammatory stage of pleurisy, if the effusion be serous in character. The duration of treatment with the salicylates is less than with alteratives, purgatives, or diuretics. For this purpose 1 to 2 drachms are given daily, in divided doses.

GASTRO-INTESTINAL DISORDERS.—The use of the salicylates is suggested by Bartholow in fermentative dyspepsia, catarrhal gastritis with the presence of sarcinae in the vomited matter, in cases of paroxysmal gastralgia, and in gastric dilatation. In gastric catarrh and intestinal flatulence salicylic acid inhibits the formation of gas.

In catarrhal stomatitis and thrush the following, applied locally, is advised: One part of salicylic acid is dissolved in alcohol and added to 250 parts of water.

In dysentery the use of enemata of salicylic acid (1 part to 300 parts of water) lessens the frequency of the stools and destroys the fœtor.

Salicylic acid has been used as an anthelmintic. For the destruction of the *Tænia solium* (tape-worm) 12 grains are taken fasting, followed by a full dose of castor-oil. For the destruction of the

Ascaris lumbricoides (round-worm) 8 grains may be given every hour until 40 grains are taken; the last dose should be followed by a purge. The *Oxyuris vermicularis* (thread-worm, or seat-worm) may be destroyed by using an enema composed of salicylic acid and borax, of each, 1 drachm; dissolved in 1 pint of warm water. This should be injected while warm. For a child use $\frac{1}{4}$ drachm of the remedies in a half-pint of water.

CUTANEOUS DISORDERS.—Salicylic acid and the salicylates have been used with benefit in various cutaneous disorders. For the relief of eczema and intertrigo a 4-per-cent. ointment may be used. In eczema of the face, in the moist or weeping stage, the following will be found efficient: Salicylic acid, 5 to 10 grains; powdered starch and oxide of zinc, of each, 2 drachms; petrolatum, $\frac{1}{2}$ ounce. If in the subacute stage stimulation be necessary, the salicylic acid should be increased to 20 or 30 grains.

Parasitic disorders generally yield to salicylic acid in the strength of 1 to 500.

H. Radcliffe Crocker (Lancet, June 8, '95) administered the salicylates in a case of psoriasis accompanied by symptoms of amygdalitis in which the improvement in the appearance of the patches from week to week was very remarkable. He has found the salicylates especially beneficial in cases of psoriasis guttata of extensive and recent development, the very form unsuited for medication by either thyroid extract or arsenic. The development of any gastrointestinal irritation was met by the substitution of an alkaline sedative for a few days and the subsequent resumption of the salicylates in smaller doses.

In the various forms of erythema multiforme, in erythema nodosum, and in

lupus erythematosus improvement followed the use of the salicylates. Erythema following horseback-riding or bicycle-riding may be relieved through the use of an ointment consisting of 10 grains of salicylic acid in 1 ounce of benzoated lard.

The itching of urticaria may be allayed by the use of a dusting-powder composed of 5 parts of salicylic acid, 15 parts of zinc oxide, and 30 parts of powdered starch. Chronic urticaria is often relieved by the internal use of 20-grain doses of salicylic acid, three times daily. For pruritus of the vulva and anus the following has been suggested: Salicylic acid, 2 drachms; cacao-butter, 5 drachms; white wax, 2 drachms; oil of nutmeg, 1 $\frac{1}{2}$ drachms.

From the use of salicylic acid for hyperidrosis of the feet and hands varying results have been reported. Equal parts of salicylic acid and powdered starch or talc will remove the foetor.

Corns and warts are best removed by the use of the salicylic-acid plaster-mull of Unna, which consists of from 30 to 50 parts of salicylic acid and 5 to 10 parts of creasote spread upon gutta-percha. A saturated solution of salicylic acid in collodion is a reliable application.

Salicylic acid has been employed as an antiseptic and deodorizer in chronic ozæna, a solution of 1 to 1000 being used as a nasal douche.

Soft chancres and venereal sores may be dressed with salicylic acid in ointment or powder. The ointment may be prepared as follows: Salicylic acid, 20 grains; alcohol, 45 drops; benzoated lard, 2 ounces. For use as a dusting-powder, 1 part of the acid is mixed with 8 parts of powdered starch or chalk.

PRESERVATIVE. — Salicylic acid has been used as a preservative for meat, fruit, wine, beer, and urine; but such

uses are not to be commended. While the acid will prevent urine from decomposing, it will sometimes cause the reaction for sugar to appear upon application of the proper test.

Unofficial Compounds and Derivatives.

ALUMINIUM SALICYLATE (salumin) occurs as a reddish-white powder. It is antiseptic and is used as a dusting-powder in nasal and pharyngeal catarrh and ozæna.

ALUMINIUM SALICYLATE, AMMONIATED (soluble salumin) occurs as a yellowish-white powder, and is soluble in 9 parts of water. It is astringent and antiseptic, and is used in inflammatory conditions of the nose and throat, as a dry insufflation or applied locally in 20-per-cent. solution (50 per cent. of glycerin and 30 per cent. of water).

AMIDOPHENOL SALICYLATE (salophen; acetyl-paramido-phenyl-salicylate). See SALOPHEN.

AMMONIUM SALICYLATE occurs in clear, colorless, monoclinic prisms which are soluble in water. It is antirheumatic, antipyretic, germicide, and expectorant. It is used in febrile conditions, bronchitis, etc., in doses of 2 to 10 grains in wafers.

ANTIPYRIN SALICYLATE (salipyrin; salazolon) occurs as a white, crystalline, odorless substance; of sweetish taste, with bitter after-taste. It is soluble in alcohol, benzin, chloroform, ether, and in 250 parts of water. It is antipyretic, antiseptic, and analgesic. It is used in sciatica, rheumatism, influenza, chorea, pleurisy, dysmenorrhœa, and metrorrhagia (especially before the climacteric). Dose, 5 to 15 grains. Maximum daily dose is 60 grains. The nitrites are incompatible with it.

ANTISPASMIN (narceine-sodium, 1 part, and sodium salicylate, 3 parts) occurs as a reddish, slightly hygroscopic, alkaline

powder; it contains 50 per cent. of pure narceine and is soluble in water. It is antispasmodic, sedative, and hypnotic. It is used in children's diseases: whooping-cough, laryngismus stridulus, irritative coughs, etc. Dose of 5-per-cent. solution in cherry-laurel water, three or four times daily: under 6 months, 3 to 5 drops; 1 year, 8 to 10 drops; 2 years, 10 to 12 drops; 3 years, 15 to 20 drops; older children take 10 to 20 drops of a 10-per-cent. solution.

BISMUTH SALICYLATE (basic salt; 64 per cent. of bismuth trioxide) occurs as a white, bulky, microcrystalline powder, soluble in acids and alkalies. It is an external and intestinal antiseptic and astringent. It is used internally in diarrhoea of phthisis and cholera infantum, in typhoid, etc., in doses of 5 to 15 grains. Used externally like iodoform.

BISMUTH SALICYLATE (acid salt; 40 per cent. of bismuth trioxide) occurs as a bulky, white powder, and loses salicylic acid when treated with ether or alcohol. It is an intestinal astringent and antiseptic, and is used in dyspepsia, gastric catarrh, enteritis, cystitis, and disorders of the alimentary canal. Dose, 5 to 10 grains.

BOROSALICYLIC ACID is a combination of boric and salicylic acids in molecular proportions. It is an antiseptic and is used externally, instead of salicylic acid, usually in the form of the sodium salt.

CAFFEINE AND SODIUM SALICYLATE. See COFFEE.

CALCIUM SALICYLATE occurs as a white, crystalline, alkaline powder which is with difficulty soluble in water. It is used, in doses of from 8 to 20 grains, in gastro-enteritis, and in smaller doses in cholera infantum.

CAMPHOR SALICYLATE (43.6 per cent. of salicylic acid; 56.4 per cent. of camphor) occurs in a white powder; soluble

in oils, alcohol, very slightly in water or glycerin. It has been used externally in ointment for lupus and parasitic skin diseases, and externally in doses of 1 to 5 grains for chronic diarrhoea and chronic dysentery.

CINCHONIDINE SALICYLATE occurs in colorless, microscopical crystals, soluble in alcohol and very slightly soluble in cold water. Its uses and doses are the same as cinchonidine.

CINCHONINE SALICYLATE occurs in white crystals, soluble in alcohol. It is used in rheumatism, especially in malarious districts, in doses of 5 to 20 grains.

CRESOL SALICYLATE (paracresalol; paracresylic ether of salicylic acid) occurs in a whitish, crystalline powder or in needles, soluble in alcohol and ether, insoluble in water. Used like salol, in doses of 5 to 15 grains (60 grains daily) in cholera, typhoid, dysentery, rheumatism, etc. Meta- and ortho- salts are used in same dose and diseases.

FERRIC SALICYLATE (salicylate of iron) occurs as a dark-brown powder, slightly soluble in water. It is tonic, antiseptic, astringent, and antirheumatic. It is used externally in hæmorrhage and wounds, and is given internally, in doses of 3 to 10 grains (in pills), in diarrhoea, rheumatism, etc.

GUAIACOL SALICYLATE (guaiacol-salol) occurs in white, insipid crystals, having a salolic odor, and soluble in alcohol. It is antiseptic, antitubercular, and antirheumatic, and is used in phthisis, diarrhoea, dysentery, rheumatism, marasmus, chorea, etc., in doses of 15 grains several times daily. Maximum daily dose is 150 grains *per diem*. (See also GUAIACOL.)

MERCURIC SALICYLATE (basic salt; about 59 per cent. of mercury) occurs as a white powder, soluble in solution of sodium chloride and in dilute alkalies. It is antisiphilitic, antigonorrhœal, alter-

ative, etc. It is said to be well borne by the stomach and to produce no salivation and is given internally in syphilis in doses of $\frac{1}{3}$ to 1 grain. It is used externally in chancre, gonorrhœa, and other venereal affections in 1-per-cent. powder or ointment, and as a urethral injection (1-10,000 to 1-2000 in water).

NAPHTHOL (BETA-) SALICYLATE (betol; naphthalol; naphtho-salol; salinaphthol; salicylate of betanaphthol) occurs as an odorless and tasteless, white powder; soluble in boiling alcohol, in ether, and benzin, but insoluble in water and in glycerin. It is an internal antiseptic, antizymotic, and antirheumatic, and is decomposed in the intestines into salicylic acid and betanaphthol. It is given in doses of 4 to 8 grains (in wafers, milk, or emulsion), 4 times daily in intestinal fermentation, cystic catarrh, rheumatism, etc.

PHENOCOLL SALICYLATE (salocoll). See PHENOCOLL.

POTASSIUM SALICYLATE occurs as a white, slightly deliquescent powder (must be kept well stoppered), soluble in water and in alcohol. It is antirheumatic, antipyretic, and analgesic. It is used, in doses of 6 to 15 grains, in rheumatism, pleurisy, pericarditis, lumbago, muscular pains, etc.

POTASSIUM SALICYLATE (potassium salicyl-aldehyde) occurs as a yellow, very deliquescent powder, soluble in water and in alcohol. It is used, in doses of 3 to 15 grains, in rheumatism, lumbago, muscular pains, etc. It must be kept well stoppered.

QUININE SALICYLATE. See QUININE.

SALACETOL (salicyl-acetol; acetol-salicylic ether) is an artificial glucoside obtained from monochloracetone with sodium salicylate and heat. It occurs in fine, white, shining leaflets of bitter taste; soluble in cold water, 15 parts of

alcohol, and in 30 parts of olive-oil. It is antiseptic and antirheumatic. It is used, in doses of 15 to 45 grains (in castor-oil, if desired), in summer complaints, diarrhœa, dysentery, rheumatism, gout, etc.

SALACTOL (salaktol) is obtained from sodium salicylate, sodium lactate, and a 10-per-cent. solution of hydrogen dioxide. It is used in diphtheria as a local application, internally in tablespoonful doses every two or three hours, and diluted with its own bulk of water as a gargle or spray.

SALICYL-ACETIC ACID (salicyl-oxy-acetic acid) is a reaction-product of sodium salicylate in soda solution with sodium monochloracetate, and occurs in lustrous leaflets, which are soluble in boiling water and alcohol, and slightly soluble in cold water, ether, chloroform, and in benzene. It is an antiseptic like salicylic acid.

SALICYLAMID, obtained from methyl-salicylate by dry ammonia, occurs in yellowish-white or colorless, thin, transparent, tasteless, but gritty, plates. It is soluble in alcohol, ether, chloroform, and in 250 parts of water. It is antiseptic, analgesic, antipyretic, and is used, in doses of 3 to 5 grains, in solution, in rheumatism, fevers, chorea, gout, etc. The maximum daily dose is 15 grains.

SALICYLBROMANILID (salbromalid; antinervine) is described as a combination of bromacetanilid and salicylanilid. Ritsert believes it to be a mixture of ammonium bromide, salicylic acid, and acetanilid (1:1:2). It should not be given in quantities containing more than the average dose of acetanilid.

SALICYLIC ALDEHYDE (salicylous acid; ortho-oxybenzaldehyde) is obtained from phenol by potassa with chloroform. It occurs as a yellow oil, forming large crys-

tals at 68° F., and has an aromatic odor. It is soluble in water, alcohol, and ether.

SALICYL-PARAPHENETIDIN (salicylidene paraphenetidin; malakin; contains 50 per cent. of salicyl-aldehyde) occurs in fine, bright-yellow needles; soluble in hot alcohol, in solutions of alkaline carbonates, slightly in cold alcohol, and insoluble in water. It is antipyretic and analgesic, and slower in action than antipyrine or acetanilid. It has been used in fevers, rheumatism, neuralgia, etc., in the dose of 15 grains several times daily.

SALICYL-RESORCIN (tri-oxy-benzophenone, resorcin-salol) is obtained from resorcin by phenyl-salicylate. It is an antiseptic, and is used in intestinal inflammations, diarrhoea, dysentery, typhoid fever, rheumatism, etc., in doses of 3 to 9 grains.

SALICYL-SULPHURIC ACID (sulphosalicylic acid) occurs in white crystals, soluble in water and in alcohol. It is used as a delicate and precise test for albumin in urine.

SODIUM BOROSALICYLATE (borosalicyl) occurs in white powder, soluble in water. It is antiseptic, antirheumatic, and analgesic. It is used, in doses of 5 to 15 grains, in rheumatism, gout, scarlatina, pleurisy, and chorea. Also used externally, with glycerin, lanolin, vaselin, etc.

SODIUM DIIODOSALICYLATE occurs in white leaflets or needles, soluble in 50 parts of water. It is analgesic, antipyretic, and antiseptic, and is used externally in parasitic skin diseases.

SODIUM DITHIOSALICYLATE (ALPHA-) is a yellowish-white powder, soluble in water, but less so than the beta-salt. It is an antiseptic and germicide. Used by veterinarians in foot-and-mouth disease.

SODIUM DITHIOSALICYLATE (BETA-) is a grayish-white, hygroscopical powder, soluble in water. It is used internally,

in doses of 1 to 10 grains, in sciatica, rheumatism, etc.

STRONTIUM SALICYLATE occurs in octahedral crystals, and is soluble in water and in alcohol. It is used, in doses of 10 to 40 grains, in rheumatism, gout, chorea, muscular pains, and pleurisy.

THEOBROMINE AND LITHIUM SALICYLATE (uropherine "S") occurs in white powder. It is used as a diuretic and nerve-stimulant. It is given, in doses of 5 to 15 grains (maximum dose, 60 grains daily), in dropsy, nephritis, and diseases of the heart and genito-urinary organs.

THEOBROMINE AND SODIUM IODOSALICYLATE—containing 40 per cent. of theobromine, 21.6 per cent. of sodium iodide, and 38.4 per cent. of sodium salicylate—occurs as a white powder, soluble in hot water. It is a heart-stimulant, diuretic, and alterative. It is given, in doses of 4 to 8 grains, two to six times per day (in capsules or wafers), chiefly in aortic insufficiency.

THEOBROMINE AND SODIUM SALICYLATE—containing 49.7 per cent. of theobromine, 38.1 per cent. of salicylic acid—occurs as a fine, white, odorless powder, which decomposes on exposure. It is soluble in hot water, hot dilute alcohol, and soda solution. It is used, in doses of 15 grains, five or six times daily (in powder, pill, or in peppermint-water), in heart disease, nephritis (especially of scarlet fever), in dyspnoea, and in coughs.

THIERSCH'S SOLUTION contains salicylic acid, 1 part; boric acid, 6 parts; dissolved in 500 parts of hot water. It is a bland, harmless, antiseptic fluid, and may be freely used without fear of poisoning from its absorption.

THYMOL SALICYLATE (salithymol) occurs as a white, sweetish, crystalline powder, soluble in alcohol, ether, and slightly

soluble in water. It is an antiseptic. Clinical data are lacking.

TOLIPYRIN SALICYLATE (tolysal; tolyl-antipyrine salicylate; para-tolyl-dimethyl-pyrazole salicylate) occurs in small, almost colorless, or faintly-red-dish, crystals, of an astringent, bitter taste. It is soluble in alcohol, acetic ether, ether, and very slightly in water. It is used in acute and chronic rheumatism, rheumatic neuralgias, etc. The antipyretic dose is 15 grains every half to one hour; as an antineuralgic, 15 to 45 grains every hour or two; for rheumatism, 7 to 15 grains every two hours.

SALIVARY GLANDS, DISEASES OF.

Xerostomia (Dry Mouth).—SYMPTOMS.

—Arrest of the salivary or buccal secretions was first studied by Hutchinson in 1887. Since then about 40 cases have been recorded. The tongue appears red, devoid of epithelium, cracked, and absolutely dry. The inside of the cheek and the hard and soft palates are also dry, and the mucous membrane is smooth, shining, and pale (Seifert). Diminution in the nasal and lacrymal secretions has also been noted, as well as dryness of the skin and crumbling or falling out of the teeth. The urine is normal. The general health and the digestion are unimpaired, but swallowing and articulation are difficult, owing to the absence of moisture. The disease usually reaches its greatest intensity rapidly, and may then remain without change for years. It usually persists until the patient dies.

ETIOLOGY AND PATHOLOGY.—Xerostomia is almost always met with in women, and about one-half of the cases occur in subjects past fifty years of age. It sometimes follows a shock. It is usually ascribed to defective nerve-function, many patients showing distinct evidences of nervous disturbance: hysteria, hypo-

chondria, anuria, etc. In some it appears to result from mere arrest of function without impairment of the general health. In 36 cases studied by A. J. Hall (Quar. Med. Jour., vol. vii, p. 26, '98) the state of the salivary glands and ducts was as follows: In 8 cases the parotids were enlarged, either equally or unequally. In 3 they were tender and painful; in 4 they were not so; and in 1 the gland ulcerated through into the mouth. In 5 cases enlargement varied from time to time; in 1 of these enlargement was most marked at the menstrual period. With 1 exception, other neighboring salivary glands were not enlarged.

TREATMENT.—Pilocarpine has been used with some success in these cases, but the condition usually recurs. Blackman employs the drug in $\frac{1}{20}$ - to $\frac{1}{10}$ -grain doses, in a gelatin lamella, which is placed on the tongue and moistened with water.

Case of xerostomia, or dry mouth, in which pilocarpine afforded relief for a time; its effects, however, soon passed off; the same was true of arsenic; and, after three and one-half years of observation, the man's condition was changed but little. A. J. Lartigau (Med. News, Oct. 29, '98).

Ptyalism.—Excessive secretion of saliva occurs as a symptom of rabies, the various forms of stomatitis, especially the mercurial form, dentition, various gastric disorders, etc.; but as an idiopathic disorder it is rarely met with. It is often observed in neurotic subjects, especially children, and usually disappears after a few years, when the development of the subject has become equalized. It occasionally attends pregnancy (*q. v.*), and may occur during menstrual periods and various febrile disorders, particularly small-pox. The effects of pilocarpine, mercury, iodine, copper, and other agents in causing ptyalism are well known.

TREATMENT.—The general health requires attention, the idiopathic form being, in reality, a manifestation of debility. Weak astringent washes, or a saturated solution of potassium chlorate, may be tried. The galvanic current, the positive pole being applied in the mouth while the latter is full of water, the negative pole being placed over the thyroid cartilage, may prove of value if used daily.

Symptomatic Parotitis.—This is an inflammation of the parotid gland occurring as a result of septic infection through the blood or through the buccal secretions, in the course of various affections, and often ending in ulceration. It may be acute or chronic. It is oftenest met with in typhoid fever, pyæmia, pneumonia, influenza, puerperal fever, erysipelas, and other infectious disorders. Inflammation of the testicles is another cause, especially when the process is gonorrhœal. Injuries of the alimentary canal and of the testicle or pelvic organs may also give rise to it. Parotitis may follow abdominal operations, especially ovariectomy, hysterectomy, and laparotomy for peritonitis. It has also been observed in cases of neuritis and facial paralysis.

SYMPTOMS.—In the acute form the gland rapidly swells. The temperature becomes raised to 103° or 104°. The whole face becomes enlarged, when both glands are involved, and the lids œdematous. The pain is sometimes very severe, owing to the tense capsule with which the gland is surrounded. Pus-formation promptly follows in the majority of cases, and the pus may burrow in various directions,—the auditory meatus, the thoracic cellular tissue, the retropharyngeal tissues, the maxillary joints, etc.,—and cause serious lesions if not promptly evacuated by incision.

In the chronic form—which may re-

sult from mumps, neighboring inflammatory processes, syphilis, the excessive use of mercury, etc.—the gland is also enlarged, but less painful, and may remain so several years.

TREATMENT.—As soon as pus is detected an incision following the course of the facial nerve, or where the abscess seems to “point” (following, if possible, any crease the face may show, to avoid disfigurement) should be practiced. The incision must be sufficiently free to thoroughly evacuate the abscess. Anæsthesia should be employed if possible, to insure operative thoroughness. The medical treatment is that indicated for mumps.

Salivary Calculus.—Salivary concretions of various sizes sometimes form in the parotid gland and its duct,—Stensen’s,—causing inflammation of the organ, retention of saliva, and enlargement of the organ. The majority of calculi, however, are found in Wharton’s duct: the duct of the maxillary gland. Foreign bodies—which, as shown by Desmartin, frequently enter Wharton’s duct—often act as nuclei. Klebs and Waldeyer contend that masses of micro-organisms are the most common causes of salivary calculi, the phosphates and carbonates of lime, magnesia, soda, etc., being deposited around them. The stones may become as large as eggs, and multiple, and are occasionally faceted. In some cases the inflammatory phenomena proceed to abscess-formation, and, spontaneous rupture taking place, a salivary fistula is formed. In the case of Stensen’s duct the opening is opposite the second molar of the upper jaw. Wharton’s duct opens beneath the tongue under the frænum. Both openings can be penetrated with a probe, or a fine needle may be inserted into the mass and its contents thus recognized.

One hundred and ninety-six cases of salivary calculus have been reported. This condition is at times mistaken for a dermoid, lipoma, ranula, or malignant tumor. Lindemann (*Deut. med. Woch.*, No. 41, p. 683, '95).

TREATMENT.—It is sometimes possible to remove a small calculus through the canal; but, as a rule, it is necessary to thoroughly anæsthetize the part with cocaine and to remove the mass by an incision through the oral tissues.

The following procedure is recommended for the cure of salivary fistula connected with Stensen's duct: Everting the cheek with the thumb on the inside and the finger on the outside, a curved needle armed with a silk thread is carried beneath and around the duct, a short distance posterior to where it opens into the mouth, both the entrance and the exit of the needle being on the mucous surface of the mouth, and not deep enough to reach the integument of the cheek. The needle is now detached from the thread, and the ends of the latter, after being tied together, are brought out of the corner of the mouth and secured to the outside of the face by a strap of adhesive plaster. As the thread ulcerates its way through the included tissues, the duct is separated from the cheek, causing the saliva to flow into the mouth, and is quickly followed by closure of the fistulous orifice on the cheek. Agnew (*University Med. Mag.*, July, '91).

Tumors of the Salivary Glands.—**CYSTS.**—Cystic dilatation of the parotid and maxillary glands or of their ducts is occasionally observed, as a result of a superficial inflammatory process or of cicatricial stenosis of the orifices. In a case noted by Stubenrauch the growth—a parotid cyst—was found studded with tubercular nodules. Stensen's duct may become inflated with air through forcible air-pressure—such as that accompanying the playing of wind-instruments, glass-blowing, etc.—and simulate a cyst.

In many of these cases it is necessary to remove the sac-wall after evacuating the contents by incision.

TUMORS OF THE PAROTID.—Tumors of the parotid are often the result of implication of the glandular tissues in neoplasms of neighboring structures. They may arise in the gland itself, however. Almost any variety of growth, especially adenoma, fibroma, chondroma, myxoma, and the malignant varieties—sarcoma and carcinoma—may be encountered.

The removal of the entire gland for large malignant growths necessitates a grave operation, owing to the proximity and frequent involvement of the external carotid, the internal jugular vein, and other important vascular and nervous structures. For this reason, large malignant neoplasms are removed with difficulty and often imperfectly. An old and good rule in such cases is to remove moveable growths: *i.e.*, those which are not firmly fixed to the underlying tissues. Benign tumors can usually be successfully extirpated. After the first free incision is made the mass should as much as possible be removed by the fingers. The facial nerve and the temporo-maxillary are thus less exposed.

TUMORS OF THE MAXILLARY GLAND.—This gland may be the seat of any of the forms of tumor met with in the parotid, but, like it, is often involved in growths that develop in the neighboring structures, especially carcinoma of the inferior maxillary. The mass usually projects beneath the jaw. The removal is not as difficult as in the case of tumors of the parotid, the facial and lingual arteries, which are easily tied, and the lingual and hypoglossal nerves, which can easily be avoided, offering no obstacle to a thorough operation. Here, also, however, it is always best to use the fingers to decorticate, as it were, the

growth after incision of the superficial tissues.

Clinical, microscopical, and pathological study of the various tumors that occur in the salivary glands. Summary: 1. The capsulated tumors of the salivary gland, and probably those which involve them from other portions of the cranium, consist of epithelial elements and a stroma that is of the nature of bone-cartilage. 2. They are benign when they present an organic arrangement, as, for instance, the epithelium and connective tissue of a gland. They are malignant when this order is altered, and the epithelium, either from trauma or by operation, is found in a wrong relation to the surrounding tissues, as in the connective tissue of the parotid gland. It develops, then, without the early characteristic stroma. The latter is also wanting when the tumor is malignant. 3. Both components of the tumor—the epithelium and the stroma—develop from embryonal tissue in the Cohnheim sense. In the embryo the conditions for a common development are present, as the parotid as well as the submaxillary gland, before they are capsulated, lie with individual acini close and firm in the periosteum of the inferior maxilla: *i.e.*, in the perichondrium of Reichert's cartilage. The cylindrical epithelium comes undoubtedly from the gland itself, perhaps also the pavement-epithelium, perhaps from the elongated layer of cells. Hinsberg (*Deut. Zeit. f. Chir.*, B. 51, H. 3 and 4, '99).

SALOL.—Salol (U. S. P.), or phenol salicylate, is the salicylic ether of phenol, or the phenylic ether of salicylic acid. It is a reaction-product of salicylic acid with phenol and phosphorus pentachloride. It occurs as a white, crystalline, almost tasteless powder, having a faint, aromatic odor. It is soluble in 0.3 part of ether, in chloroform, in 10 parts of alcohol, and in benzin and the fatty oils, and insoluble in water. Salol contains 60 per cent. of salicylic acid and 40 per cent. of phenol (carbolic acid), which

fact should be remembered when prescribing it.

Dose and Physiological Action.—The ordinary dose of salol is from 3 to 15 grains. As an antipyretic, the dose should be somewhat larger: from 30 to 45 grains. These larger doses are, however, not advised, on account of the danger of carbolic-acid poisoning.

Ewald (*Berl. klin. Woch.*, xxvi, p. 975, '89) states, as the result of experimental research, that salol is not decomposed in the stomach, but immediately upon its entrance into the intestines it comes in contact with the pancreatic juice, and is broken up into its original constituents,—salicylic acid and phenol,—the products of decomposition appearing almost at once in the urine in the form of salicyluric acid, which yields a red precipitate with chloride of iron. Ewald proposed taking advantage of this fact in order to determine the rate at which food passes from the stomach. After free use of salol the urine becomes black from the products of destruction of carbolic acid, and it is capable of causing the symptoms of poisoning by salicylic acid and by carbolic acid, but is said to be less powerful as a poison than are its un-united ingredients, probably because it is broken up slowly and perhaps escapes in part unchanged (H. C. Wood). P. Cornet (*Progrès Méd.*, Oct. 29, '92) has found that it increases nitrogenous elimination.

Poisoning by Salol.—Salol owes its poisonous properties to its constituents, carbolic acid and salicylic acid, chiefly the former. The relative infrequency with which it has caused death is probably due to the reasons above suggested by H. C. Wood. Salol is absorbed slowly, but is also eliminated slowly; so that there is danger of accumulation in the system, if given too frequently, unless diarrhœa

be present. It would follow that larger doses would be accompanied with less danger in the latter cases.

The importance of the formation of salol calculi, apart from the serious symptoms to which they may give rise, lies in the fact that the activity of the drug is markedly diminished. The chief fault seems to be in the method of administration. Salol—and the same thing holds good for other insoluble bodies of similar melting-point—ought to be rubbed up with some innocuous powder, or given in the form of an emulsion, as recommended by Sahli. C. R. Marshall (*Brit. Med. Jour.*, July 10, '97).

Josias reported the case of a young girl in whom a large patch of scarlatiniform erythema, together with rose-colored papules and spots resembling those of measles, appeared upon various portions of the body after taking 45 grains. The insufflation of salol for the relief of otorrhœa has caused extreme swelling of the external auditory meatus, the isthmus of the fauces, and of the uvula. Josephowitsch reports a case in which 350 grains had been given in four days, where intense albuminuria and violent pains in the loins appeared. Hesselbach claims that salol is dangerous and contra-indicated when renal disease is present, on account of the untoward action of carbolic acid upon the renal cortex. He reports a death of an adult after taking 120 grains for acute rheumatism within eight hours. Chlapowski reports a case in which death apparently followed the ingestion of 15 grains (Nowiny Lekarske, No. 4, '90). It is recommended that a soluble sulphate, as Glauber's salt, be given during the administration of the drug to a patient who is either weak or possesses an idiosyncrasy to the use of carbolic acid.

The powerful action of salol against microbes is due to its splitting up, in

any alkaline medium, into salicylic and sulpho-carbolic acids. Its internal use requires caution in fevers, in acute or chronic diseases of the kidney, and arthritic cases with cuticular congestions. Manceau (*Thèse de Paris*, No. 159, '96).

Therapeutics. — Salol was introduced into medicine, and is now used, as a remedy for rheumatism to take the place of salicylic acid in those cases where the stomach is irritable and will not tolerate the latter. Its applicability is similar to that of salicylic acid. It is useful in acute articular rheumatism, in muscular rheumatism, and myalgia due to exposure. It may be used alone or combined with phenacetin or other remedy.

Its analgesic properties are also manifested in the alleviation of the pain in migraine, various forms of neuritis, and locomotor ataxia.

Gouguenheim and Caport value highly the internal use of salol in pharyngeal inflammations, 5 grains (alone or combined with equal parts of terebene in capsule) three times daily affording relief, especially in those cases of chronic pharyngitis which are incident to the uric-acid diathesis. Combined with terpin hydrate (3 grains of each), it has been found useful in the treatment of bronchitis, catarrhal fever, and colds generally (S. Solis-Cohen). In influenza the combination of salol with phenacetin or acetanilid will relieve the pains and discomforts attendant upon that disease.

Salol has been found of greatest value in the treatment of duodenal catarrh and catarrhal jaundice. In hepatic catarrh, when there is a tendency to inspissation of the bile and in cholelithiasis, salol appears to render the bile more fluid and relieve the general symptoms. In these cases 10 grains are given three times daily.

Gonorrhœa in all its stages is amenable to salol. Being excreted by the kidneys, the urethra is sterilized by the antiseptic urine at every micturition. Salol may be combined with copaiba or sandalwood oil, which it dissolves without difficulty. J. William White, in recent urethritis, recommends the following in a capsule 4 to 6 times daily:—

R̄ Salol, 3 $\frac{1}{2}$ grains.
 Oleoresin of cubebs, 5 grains.
 Balsam of copaiba (Para), 10 grains.
 Pepsin, 1 grain.—M.

In a majority of cases he also uses an injection of 2 grains of zinc sulphocarbonate in a 10- to 15-per-cent. solution of hydrogen dioxide.

Good results follow the use of salol in all affections of the bladder and urethra. It is especially beneficial in pyelitis, cystitis, and fermentation of urine in the bladder, by reason of its antiseptic action upon the urine. Five grains every three or four hours, or 10 grains thrice daily, appear to be sufficient in these cases.

Salol has been used extensively in intestinal disorders. Intestinal indigestion and fermentation are amenable to salol alone or in combination with bismuth, chalk, etc. Diarrhœa due to decomposition is arrested; the summer diarrhœa of children, dependent upon indigestion and consequent fermentation, is checked by salol by reason of its antiseptic action upon the intestinal canal and its contents. Fussell commends the following mixture in cases of cholera morbus:—

R̄ Salol, 1 drachm.
 Bismuth subnitrate, 2 drachms.
 Chalk mixture, enough to make 3 ounces.

M. Sig.: A dessertspoonful to be taken every two hours.

Good results have been reported from the use of salol in Asiatic cholera. Girode, however, has shown that salol is apt to increase the gastric disturbance which accompanies cholera, and cautions against its use in this disease and in all in which ulcerous conditions of the alimentary tract are present.

Mild or pernicious anæmia is greatly benefited by salol when dependent upon the development of decomposition-products.

Salol and antipyrine combined have been used successfully by Labadie-Lagrave for the control of uterine hæmorrhage. Equal parts of these two substances are heated together in a test-tube over a lamp until a deep-brown mixture forms. As soon as it is sufficiently cool, a film of cotton on an applicator is dipped into it and passed within the uterine cavity. This is repeated two or three times in succession. The applications are painless and are not followed by unpleasant effects; a second application is seldom needed. In fungous endometritis the applications are made after curetting, and are found to be antiseptic, hæmostatic, and tend to prevent relapse.

The employment of salol as a coating for pills designed especially for enteric medication should receive mention.

Salol has been used externally as a dressing for wounds, burns, and ulcers, as an antiseptic and deodorant, similarly to iodoform, in the form of gauze, dusting-powder (1 part to 1-3 parts of starch or French chalk), collodion (4 parts to 4 parts of ether and 30 parts of collodion), and of 5- to 10-per-cent. alcoholic solution (with 20 volumes of water for gargling in angina, pharyngitis, etc.), or dissolved in oil, balsam, or in ointment. In ointment and dusting-powder it has been found beneficial in impetigo,

eczema, and sycosis (Saalfeld), and has been used as an insufflation for the relief of ozæna.

A mixture of salol and iodoform, which, on heating, becomes liquid, and remains so for fifteen or twenty minutes at the temperature of the body has been used in irregular cavities, cold abscesses, fistulas, and bone-cavities, for the purpose of obtaining asepsis. Reynier (*Sem. Méd.*, No. 19, '96).

Capitan claims to abort acute coryza by using an insufflation into each nostril of the following powder:—

R Salol, 15 grains.
Salicylic acid, 3 grains.
Tannic acid, 2 grains.
Powdered boric acid, 1 grain.

This should not be used too freely, as it is not free from caustic action; not too frequently, and not longer than a few hours at most.

Five-per-cent. alcoholic solutions with various flavoring agents are used in the preparation of dentifrices, mouth-washes, and other toilet preparations.

CAMPHORATED SALOL.—This is prepared by mixing 3 parts of salol and 1 part of powdered camphor, heating gradually to complete fusion and filtering. It occurs as a colorless oily liquid, soluble in alcohol, ether, chloroform, and oils. It should be preserved in yellow, hermetically-sealed bottles. This substance is a local anæsthetic, antiseptic, and analgesic. It has been found useful in toothache, earache, suppurative otitis media, neuralgia, rheumatism, typhoid fever, and gastric affections. The dose for internal administration is from 3 to 10 grains.

Bowen says that camphorated salol is of special value in the treatment of furuncles and carbuncles. After it has been applied locally for twelve to twenty-four hours the pain diminishes, the redness and inflammation disappear, and

the tumor becomes smaller, without the production of pus. If suppuration be present, lay open freely and cover with cotton compress soaked in camphorated salol; an impermeable dressing is placed over all and secured with a bandage. (*Boston Med. and Surg. Jour.*, Sept. 19, '95.)

SALOPHEN.—Salophen (acetyl-paramido-phenyl salicylate) contains 50.9 per cent. salicylic acid. It occurs in fine, white, odorless and tasteless scales; soluble in alcohol, ether, alkalies, and hot water, and nearly insoluble in cold water. It is not official.

Salophen was introduced as a substitute for salicylic acid and salol by P. Guttman (Berl. klin. Woch., No. 52, '91). It is said to be less poisonous than salol or salicylic acid, because the phenol of the latter remedies is replaced by an innocuous compound of phenol.

Dose and Physiological Action.—Salophen, like salol, seems to suffer no action until it reaches the intestines, when the pancreatic juice splits it up into its component parts, salicylic acid and acetyl-paramido-phenol. As the latter appears innocuous, the further action of salophen is that of its contained salicylic acid. It has, however, certain advantages over the latter in that it is unirritating and tasteless and is not depressing. It may be given for considerable periods of time without causing nausea, anorexia, tinnitus, or other unpleasant symptoms. It possesses antiseptic, antipyretic, and analgesic properties, and is given in doses of from 5 to 15 grains. The maximum single dose is given as 20 grains; not more than 90 grains should be given during the twenty-four hours.

The results of a long series of observations on the use of salophen show that it is three times less toxic than

salol. When taken by the mouth it passes through the stomach unaltered, and it is only in the intestine, when exposed to intestinal and pancreatic secretion, that it breaks up. The salicylic acid uniting with glycol is largely eliminated in the urine, either as nascent salicylic acid or as salicylate of sodium. The acid phenol unites to the radical HSO_3 , forming a sulphate with that body. A certain amount of salophen is eliminated unchanged. There is evidence of the slow decomposition undergone by this substance, so that the organism is continually under its influence. There seem to be very few instances of intolerance, and bad effects are also very rare. Salophen is free from smell or taste, and the most convenient method of administration is in cachet. Baqué (Jour. de Méd., Sept. 10, '97).

Therapeutics. — The therapeutics of this remedy are the same as those of salol and salicylic acid. It is given in the same cases, and in similar doses, and is generally to be preferred to either of them, for the reasons given above. It is well suited, also, for use in diseases of children.

The use of salophen avoids the toxic effects produced by some of the other salicylic compounds. Fourteen cases of acute rheumatism were treated in the Bellevue Hospital by means of salophen, the drug being administered in 15-grain doses, along with 15 grains of sodium bicarbonate, every four hours. Analyzing the cases,—excluding two, on the ground that the temperature was produced by other factors than acute articular rheumatism,—the average duration of fever, after beginning to use salophen, was five days. According to Dr. Whipman, the average duration of fever in 173 cases, treated with salicylates, was 8.65 days.

There were no symptoms of gastric irritation, cardiac depression, or renal or cerebral involvement in any of the salophen cases which could be attributed directly to the drug. Pearse (N. Y. Med. Jour., Mar. 14, '96).

Salophen has a most favorable influence upon psoriasis. The left leg of one

patient was treated with 10-per-cent. chrysarobin-traumaticin, and the right leg with 10-per-cent. salophen salve. The better result was obtained with the latter method. Lehmann (Ther. Woch., Sept. 26, '97).

Salophen exerts an incontestable action upon acute and subacute rheumatism, but its effects are less constant than those of salicylate of sodium. In chronic and blennorrhagic rheumatism it has not shown itself superior to other drugs. Salophen possesses a powerful analgesic action, which is exercised even in those cases where this drug cannot be looked for to effect a cure. It has given good results in migraine, in various neuralgias, and in sciatica. Salophen employed in a medium dose produces no phenomena of intolerance, nor does it occasion headache, buzzing in the ears, or troubles of vision, but intolerance appears to be rapidly induced. In certain cutaneous affections salophen appears to have some efficacy. The medium dose of salophen is 60 grains daily, more or less, according to the gravity of the complaint. Creslé (Gaz. Hebdomadaire de Méd. et de Chir., Dec. 18, '98).

Salophen is harmless in daily amounts of from 45 to 90 grains. Since it is odorless and tasteless, it can be administered as a powder, in compressed tablets with starch or sugar of milk, or as pills. It passes through the stomach unchanged, without producing any gastric disturbances, and in the intestine is so slowly broken up into salicylic acid and acetoparamido-phenol that the former acts *in statu nascendi* for a considerable period of time, but does not give rise to untoward action. It is an excellent anti-rheumatic, acting in acute and subacute articular rheumatism equally as well as do salicylic acid and sodium salicylate, but without their unpleasant after-effects. In chronic articular rheumatism it is no more useful than the above-mentioned drugs. It is an excellent anti-neuralgic and analgesic in cephalalgia, migraine, odontalgia; facial, trifacial, and intercostal neuralgia; and in the nervous form of influenza. It produces good results in chorea. It acts well in various skin affections which are accom-

panied with itching: prurigo, urticaria, pruritus of diabetes, eczema, and psoriasis. Drews (Ther. Monats., H. 3, '98).

SANDAL-WOOD AND OIL OF SANDAL-WOOD.—Sandal-wood (red saunders; *Santalum rubrum*, U. S. P.) is the wood of *Pterocarpus santalinus* (nat. ord., *Leguminosæ*). It occurs in the form of raspings. It contains a red coloring matter of a resinous character, known as santalic acid, or santalin, which occurs as a red, crystalline powder; soluble in alcohol, ether, and in acetic acid, but insoluble in water. It is not employed for any individual virtue, but is used in pharmacy for imparting a red color to alcoholic solutions and tinctures. It is the coloring principle of the compound spirit (or tincture) of lavender.

Oil of sandal-wood (oil of santal; *oleum santali*, U. S. P.) is a volatile oil distilled from the wood of *Santalum album* (nat. ord., *Santalaceæ*), indigenous to India. The oil has a yellowish, or pale-straw, color; a spicy taste; and an aromatic odor.

Physiological Action and Dose.—It is a stimulant in small doses, and an irritant in large doses, to the various mucous membranes. It checks the secretions of the mucous membranes and causes dryness of the throat and thirst. S. Rosenberg has noticed, after doses of 60 drops a day, irritation of the alimentary canal, burning in the urethra during micturition, and an eruption of small red prominences upon the entire surface of the body, involving even the conjunctivæ.

Its general action upon the system is unknown. It seems to be more stimulating than oil of eucalyptus, and rather less so than terebene. When taken internally, it is eliminated by the urinary and respiratory mucous membranes; the odor is sometimes perceptible in the perspiration. Unlike copaiba, it causes no cu-

taneous eruptions, and is less likely to produce gastric or intestinal disturbance. Absorption and elimination are very rapid; it may be detected, by its odor, in the urine half an hour after its ingestion. It may be given in doses of from 5 to 30 minims, in capsules or dissolved in alcohol and flavored with cinnamon, in emulsion, or on sugar.

Therapeutics.—Oil of sandal-wood is an efficient remedy in asthma, chronic bronchitis, in the advanced stages of acute bronchitis, and in the advanced stages of gonorrhœa. It is also used as an ingredient of perfumes.

SCABIES.

Definition.—An inflammatory contagious disease of the skin, due to the presence of the *Acarus scabiei* and attended by severe pruritus.

Symptoms.—The eruption produced by the *Acarus scabiei* consists of scattered vesicles and papules, which are usually located between the fingers and on the flexor side of the wrists and elbows. The axillæ, mons veneris, abdomen and buttocks, the penis, the mammæ, and in children the legs and feet are the points of predilection next in order. The burrows of the parasite resemble scratches, which, upon close examination, may be seen to be beaded. The *Acarus* may readily be extracted from its burrow with the tip of a needle for microscopical examination. The eruption is attended with severe itching, which is especially marked at night. The scratching to which the patient subjects the parts greatly increases the local irritation. The eruption may become pustular or complicated by other dermatoses (eczema, urticaria, etc.), and present various characteristics due to the accumulation of epidermic *detritus*, dead *acari*, etc., or accumulated crusts. The

hairs of the limbs affected are often shed, and the nails may become hypertrophied. The incubation-period extends from two days to a week. Occasionally the itching is absent: apruriginous scabies. During a general illness scabies is apt to disappear or improve; but the disease reappears as soon as convalescence is established.

Acarus does not inhabit the prickly layer, but the undermost part of the middle layer of the epidermis. The eczema of scabies is not caused by scratching, but by irritating substances given off by the *Acarus*. Török (Monats. f. Prakt. Derm., vol. viii, No. 8, '89).

Etiology.—The *Acarus scabiei* is about one-quarter millimetre long, and resembles an eight-footed turtle in general outline; the males live under the skin or epidermic scales, the females under the epidermis in the burrows, where they deposit their eggs. The disease is very contagious, through contact with affected individuals and any wearing apparel or bedclothing that they may have used.

Treatment.—Scabies may be rapidly cured by adopting Hardy's method: scrubbing with soap and water, using a brush, twenty minutes; the same procedure, thirty minutes, but with the part immersed in the soap-water; rubbing of the part with the Helmerich-Hardy ointment:—

R Carbon. of potass., 25 grains.

Sulphur, 50 grains.

Lard, 5 drachms.—M.

This is left on two hours and the parts are bathed as before, but not brushed. Pruritus may usually be relieved by means of a 2-per-cent. menthol ointment. Vaseline or cosmolin is sometimes sufficient.

The simple sulphur ointment thoroughly, though gently, applied at night before retiring, followed the next morning by a warm bath, is often sufficient

to cure scabies when persisted in two or three weeks, but the underwear should be very frequently changed. In many cases the ordinary sulphur ointment is too strong; it is always best to reduce its strength by mixing it with an equal quantity of benzoated lard. Sulphur-baths are also valuable, but ointments can be kept in contact longer with diseased parts, and are therefore more destructive to the parasite.

Large number of cases treated by painting the entire body with the balsam of Peru, which exercises a toxic action on the *Acarus*. No soap and water should be used before its application. With a brush a thin layer of the balsam is laid on at night, followed by gentle rubbing. A bath is taken on the following morning. The remedy causes no irritation and is always well borne. Julien (Province Méd., Nov. 21, '96).

Tincture of benzoin used with excellent effect in two cases. The itching ceased after the first application of the tincture, and the eruption began to decline. Effects ascribed partly to the alcohol and partly to the benzoin. V. Holstein (Rev. Gén. de Pharm. et d'Hyg. Prat., vol. i, p. 5, '98).

Endermol (nicotine salicylate) used in 63 cases of scabies, six applications of a 1-per-cent. ointment being used. In stronger proportions toxic effects are produced. It is free from odor and does not stain linen. It proved curative in all cases. Wolters (Ther. Monats., Aug., '98).

Thirty-two cases of scabies have been successfully treated with nicotine soap. It is of a dark-brown color, and may be scented with oil of bergamot. It consists of tobacco extract, 5 per cent.; precipitated sulphur, 5 per cent.; and overfatty soap, 90 per cent. The patient is washed with warm water night and morning, and is then anointed from head to foot with this soap, which is allowed to dry on. This process is repeated for three or four successive days, when the cure is complete, and then he is given a hot plunge-bath. This ointment is free from unpleasant odor, and does not dis-

color the bed- or body- linen of the patient. Marcuse (Ther. Monats., Dec., '99).

After thorough bathing, the body and limbs should be rubbed lightly with washed sulphur, less than $\frac{1}{2}$ teaspoonful for each person; this to be followed by clean underclothes and clean sheets with $\frac{1}{2}$ drachm of sulphur dusted between them. If this is repeated every second or third day the cure, in ordinary cases, is complete in a week. No resultant dermatitis noticed. S. Sherwell (Med. News, Oct. 13, 1900).

SCALP AND SKULL, SURGERY OF.

See HEAD, INJURIES OF THE.

SCARLET FEVER.—Scarlatina. (Lat., *scarlatinus*; *febris* understood.)

Definition.—Scarlet fever is an acute, infectious, contagious, eruptive, disease presenting, in typical cases, the following features: After a period of incubation of from two to four days there is a sudden onset of sore throat, vomiting, and fever; within twenty-four hours a characteristic eruption appears and continues for about six days, when it terminates in desquamation.

Symptoms.—From the attack so mild that diagnosis is difficult to the fiercely-malignant form we see every possible degree of severity. Notwithstanding this variability of type, the majority of cases pursue a fairly-uniform course, and may, with propriety, be called ordinary cases. Other types may be described as mild, severe, and malignant.

ORDINARY TYPE.—The invasion is usually sudden, and is marked by vomiting, fever, sore throat, and rapid pulse. Occasionally a short period of malaise precedes the onset of definite symptoms. In older children a chill is sometimes the first symptom; in younger children a convulsion. The vomiting is usually repeated several times, and is not accompanied by nausea. When it occurs late

in the disease it is a far more unfavorable symptom than at the outset. The intensity of the period of invasion is usually indicative of the severity of the attack, though this is a rule subject to many exceptions.

A clinical phenomenon in scarlatina in the most characteristic instances consists in a paresis of the extremities, the patient complaining that he cannot move the hands or feet. This degree of disturbance, however, is very exceptional. Most frequently there is only a numbness of the hands, with sensations of tingling or formication. Numbness may be absent, and then the patient experiences pricking sensations localized in the extremities of the fingers or in the palm of the hands. Disturbances in the feet are of rarer occurrence; they may be noticed alone or in conjunction with those described in the hands.

This sign appears during the period of eruption, exceptionally before it. Its duration is very variable; it may be experienced for only a few minutes, and not be felt again. In the majority of cases it is more durable, appearing several hours or a day after the beginning of the eruption and persisting for two or three days, ordinarily with interruptions. It may even be delayed in its appearance until the third, fourth, or fifth day of the eruption. It is accompanied by no painful sensation. Some patients experience this disturbance only when they wish to use the hands; others at the moment of leaving the cold bath or when the hands are dipped into water.

This sign is very constant.

This sign in other eruptive diseases has not been encountered. Meyer (Presse Méd., p. 119, '98).

The temperature is frequently found to be 103° F. at the first visit and may reach 104° or 105° on the first day. A temperature on the first day above $104\frac{1}{2}^{\circ}$ indicates a severe attack; below 102° a mild attack. The highest point is commonly reached at the height of the eruption. It then begins to subside and becomes normal at a varying period, rang-

ing from the ninth to the fifteenth day. The fever is frequently remittent and in mild cases almost intermittent in character. There is no typical temperature-range. The febrile stage, even in quite severe cases, may be limited to six or seven days, or it may be prolonged to fourteen or fifteen days without obvious cause.

A pulse abnormally rapid as compared with the height of the temperature is quite characteristic of scarlet fever. It is often 150 on the first day, and continues rapid through the disease.

One of the earliest symptoms is sore throat. The fauces, tonsils, and pharynx are of a uniform bright-red color, and on the hard palate numerous dark-red macules may be seen. In mild cases the throat symptoms may be very slight; in more severe cases the tonsils may be studded with follicular spots or smeared over with a tenacious exudate closely resembling a pseudomembrane. There is frequently a discharge from the nose, which may consist of clear, tenacious mucus or muco-pus. The glands at the angle of the jaw frequently become enlarged.

In scarlet fever there is a general intense redness of the whole throat, including the hard palate. The entire mucous membrane is affected, and the small dots, which in connection with the hyperæmic condition of the skin represent the condition of a punctate erythema, from being localized on the moistened mucous membrane, have a little darker appearance than the adjacent reddened tissue. In measles, on the contrary, the mucous membrane of the throat has a blotchy appearance, and is of a darker red than is seen in scarlet fever, while the mucous membrane between these blotches is but slightly congested in comparison with that of scarlet fever. T. Rotch (Boston Med. and Surg. Jour., May 27, '97).

Examinations of 100 cases with reference to the enlargement of the lymphatic glands. The inguinal glands were en-

larged in 100 per cent., the axillary in 96 per cent., the maxillary in 95 per cent., the posterior cervical in 77 per cent., the anterior cervical in 44 per cent., the submaxillary in 36 per cent., the epitrochlear in 26 per cent., and the sublingual in 25 per cent. The enlargement seemed to correspond with the intensity of the toxæmia. The main value lies in recognizing scarlet fever from scarlatiniform eruptions due to various toxins or drugs. In these the glands are not so universally enlarged. J. F. Schamberg (*Annals of Gynec. and Pæd.*, vol. xiii, No. 3, '99).

As the disease progresses, the tongue, which is at first coated, often assumes the so-called strawberry appearance. Much confusion exists as to what the strawberry tongue really is. It is not a white tongue with red papillæ; such a tongue is seen in various conditions. The true strawberry tongue was originally described by Flint as follows: "The tongue in the first days is usually coated. In the progress of the disease the tongue usually exfoliates, leaving the surface clean and reddened and the papillæ enlarged. The appearance is strikingly like that of a ripe strawberry. The strawberry-like tongue is a pathognomonic symptom; it is peculiar to this disease. It is often, but not uniformly, present." The term should be applied to the red, clean tongue with prominent papillæ which follows a coated tongue.

All agree that during the first three or four days of scarlet fever the tongue is white-coated, with the papillæ prominent, sticking out through the white fur, as if the tongue had been sprinkled with red pepper. After the fourth day this coating disappears, sometimes gradually, sometimes quickly, leaving the tongue of a bright, shiny red, and very prominent papillæ.

The first conditions, while common in scarlet fever, and while the redness of the papillæ is more marked in that disease than in any other, do not occur in many febrile affections, especially where

there is irritation of the digestive tract. Therefore, it cannot be in itself characteristic of scarlet fever. The more or less sudden desquamation of the tongue, leaving it bright red and rough, with prominent papillæ, does not occur in any other disease, and is therefore characteristic of scarlet fever. If the term strawberry is to be applied at all, it should be to the rough, bright-red tongue with prominent papillæ. M. H. Fussell (Univ. Med. Mag., May, '97).

An early and constant symptom in scarlet fever is a rash which appears on the soles of the feet and palms of the hands after twenty-four or thirty-six hours of the stage of invasion. It is bright red, not mottled, and accompanied by swelling. The whole of the sole of the foot is not affected, as toward the centre near the highest part of the plantar arch an elliptical patch of skin retains its normal color. Sometimes the redness extends along the heel and around the sides of the foot. This rash lasts sometimes only a few hours, but generally it persists for a couple of days; then the color changes to violet. About the fourth day it becomes duller, of an earthy or brownish hue. On the fifth and sixth days it disappears. Stoupy (Archiv de Méd. et de Pharm. Milit., July, 1901).

Mayer, in 1898, called attention to a sign of scarlet fever which is not mentioned by classical authors, and was probably confounded with rheumatism. This symptom consists of an engorgement of the hands, which appears at the same time as the eruption, and is often accompanied by prickling and formication. As a rule this swelling is slight, but sometimes it is marked. The engorgement is usually localized in the hands, and occasionally limited to their palmar surface. Mayer occasionally noted engorgement of the whole upper extremity. It is rare on the feet excepting when it is confined to the heels and toes. This swelling commonly appears in connection with, or a little in advance of, the eruption, rarely later, and it lasts from a few hours to one or two days. The writer during his service at d'Aubervilliers has frequently

observed this symptom in scarlatina, but has never found it in the other eruptive fevers. He has found Mayer's description and analysis of the symptom to be exact. Ch. Aubertin (Archives de Méd. des Enfants, April, 1903).

The eruption usually appears within twenty-four hours after the initial vomiting. It is not infrequently seen after twelve hours, and is sometimes delayed for thirty-six hours and in rare cases to the fourth or fifth day. There is frequently intense itching or burning of the skin. The rash is usually well developed during the second day of its appearance. It then continues from four to six days, when it gradually subsides. It usually appears first over the front of the neck and upper part of the chest. It consists of minute points of bright-scarlet color closely grouped together on a slightly-reddened skin. They become confluent in places, forming bright-scarlet patches, but over the most of the surface they remain discrete throughout. Being hyperæmic in nature, the rash disappears on pressure, leaving, for a perceptible time, a white spot. An eruption of very fine vesicles is seen in rare instances, and occasionally a blotchy eruption appears early on the face, but subsides as the typical rash develops.

One of the most characteristic symptoms of scarlet fever is the desquamation. It rarely begins before the sixth day, and is frequently delayed until the second week. It appears first on the neck and between the fingers. It begins as fine, branny scales, but soon changes to large lamellar scales. Sometimes the skin can be peeled off in strips. It continues from ten to thirty days, and is most persistent where the skin is thickest. It frequently continues about the fingers and nails after other portions of the body are clear, which explains the readiness with which the disease is conveyed by letters. When

the skin has received careful attention, the desquamation is sometimes almost imperceptible. In rare instances a second desquamation occurs.

The urine becomes scanty and high colored during the febrile stage, and frequently contains a slight amount of albumin and sometimes blood and hyaline casts. Except in the more severe forms, suppression is rare and dropsy still more so. These symptoms usually subside as the fever falls. The kidney symptoms at this stage rarely prove serious. They may, however, do so, and always demand attention. The more serious kidney symptoms occur later and will be considered as a complication.

Scarlatinal nephritis is a disease *sui generis*: a diffuse nephritis, developing, as a rule, about the third week, and accompanied by general anasarca. The urine contains a large quantity of albumin and numerous casts of all varieties. Often the first indication of the onset is a sudden fall in the specific gravity of the urine, followed in a short time by a sudden rise in specific gravity, associated with a diminution in the total quantity of the excretion. Engorgement of the renal vessels has then occurred, and no time should be lost in instituting active treatment. Frequently before the appearance of albuminuria there may be a marked increase in urates. Kemp (*Archives of Pediatrics*, July, 1900).

MILD TYPE.—Scarlet fever is sometimes so mild as to render diagnosis very difficult. The symptoms may be so slight that medical aid is not sought. As a rule, however, there is an onset of vomiting, fever, and sore throat, as in the ordinary type, but none of the symptoms are urgent. The vomiting is not persistent, the temperature does not rise above 102° or 103° F., and the throat presents only the symptoms of mild pharyngitis. I have seen an undoubted case in which the temperature never rose to 101°. It may become normal on the

fourth or sixth day. The eruption is often very faint, and may not appear on the face. It may, however, be bright and distinctive for twenty-four hours and then fade away so rapidly as to have disappeared by the fifth day. In rare instances it is an evanescent rash which disappears entirely within twenty-four hours. Nephritis may be a sequel, due in many cases to exposure and lack of care: the natural results of so mild an illness. Owing to this lack of care and isolation, the patient may become very dangerous to others. It is by these mild cases that the disease is sometimes sown broadcast. A mild attack in one child may produce a malignant one in another.

The appearance of a punctate eruption in the armpits and in the groins, together with the congestion of the tonsils and a punctate eruption in the roof of the mouth, no matter whether there is any eruption elsewhere or not, are positive proofs of scarlet fever. The most characteristic feature of the disease is the enlargement of the papillas of the tongue. It appeared as the one constant symptom in each of 1000 cases examined. It is often important to make a diagnosis of scarlet fever after the rash has subsided, in order to prevent infection during the period of desquamation. Here the existence of a white line at the junction of the pulp of the finger with the nail is of great assistance. J. H. McCollom (*Phila. Med. Jour.*, June 3, '99).

Four cases of miliary scarlet fever showing that a miliary eruption may be present in a mild case, with a slight rash and without extensive peeling. The development of miliaria probably due to some peculiarity of the cutaneous tissues. J. P. C. Griffith (*Jacobi's Festschrift*; *Phila. Med. Jour.*, May 12, 1900).

SEVERE TYPE.—Not only are the symptoms of this type severe, but the various stages are prolonged. The fever may continue for three weeks or more, and the stage of desquamation for even a longer time. A fatal termination is common, death occurring usually during

the second week. The chief peculiarity which distinguishes this from the ordinary type is the presence of septic symptoms due to streptococcic infection. The type might, therefore, with propriety be called the *complicated type*. The throat is usually the first to show the evidence of streptococcic invasion. On the third day and in some cases on the first or second day a membranous exudate appears on the tonsils and soon invades the pharynx and naso-pharynx. A purulent nasal discharge appears, and the lymphatic glands at the angle of the jaw begin to swell, the cellular tissues being so involved as to often cause immense enlargement. The Eustachian tubes are involved, and purulent otitis media follows; but the larynx commonly escapes. The urine contains albumin and perhaps blood-cells and hyaline and epithelial casts. Symptoms of general septic infection rapidly supervene. There is low delirium or stupor; the child refuses nourishment and may die from exhaustion; but sudden death is not uncommon. Others, after overcoming one complication after another, slowly recover after a tedious convalescence.

Study of 2600 cases of scarlet fever. There were 62 cases of arthritis, the wrists, knees, phalanges, and the elbows being most frequently involved in the order given. Occasionally there was a functional bruit over the heart, but in no case was this endocarditis. The 62 cases of arthritis believed to be septicæmic and due either to the germ of scarlet fever or to cocci which had followed them. Six cases with affected joints presented some form of heart lesion. J. G. McNaughton (Edinburgh Med. Jour., Aug., 1900).

MALIGNANT TYPE.—Though very rare, malignant scarlet fever does sometimes occur. It begins with convulsions and hyperpyrexia. The scarlatinal poisoning may be so intense as to cause

death within twenty-four hours. More commonly, death does not occur before the third or fourth day, the patient being comatose or delirious. The nervous symptoms are so marked that some writers have given to this type the name of cerebral scarlet fever. In a case of my own the initial symptoms were convulsions, hyperpyrexia, and hæmaturia.

SURGICAL SCARLET FEVER.—Patients who have undergone surgical operations are unquestionably very susceptible to scarlet fever. Such scarlet fever, however, is not essentially different from the usual disease. It is simple scarlet fever in a surgical case. It is, no doubt, true, as Osler has shown, that the eruption which has frequently led to a diagnosis of scarlet fever is nothing more than the red rash of septicæmia. It is a fact that surgical scarlet fever is much less common since surgical septicæmia has become less frequent.

There are about 174 cases of surgical scarlatina reported in the literature more or less in detail, and passing mention is made of many more. Operations and wounds of all kinds, as well as inflammatory processes, are supposed to predispose to scarlatinal infection.

Surgical scarlatina is said to differ from medical scarlatina in five ways: 1. The large number of adults attacked. 2. The shorter period of incubation. 3. The mild angina or absence of angina. 4. The fact that the eruption begins at the wound or in some other unusual region. 5. The slightly precocious desquamation.

Proof of the existence of a special form of scarlatina occurring in connection with wounds rests upon the large number of cases recorded in which the eruption resembling that of scarlet fever followed some injury, and upon the frequency of epidemics of scarlet fever among surgical cases, in the days before complete isolation of fever cases was practiced.

Careful examination of the reported cases confirms the view held by most French writers, that the eruption in question is often due to septic infection and is not scarlatinal; and that the variations of so-called surgical scarlatina from the typical form of scarlet fever are not due to the unusual mode of infection, but to the difference in the infectious agent. In the cases where the disease was undoubtedly scarlatina, there is no convincing evidence that the relation between the wound and the scarlet fever was anything more than one of coincidence. There is, as yet, no convincing proof in the literature that surgical scarlatina is anything more than scarlet fever in the wounded. Alice Hamilton (*American Journal Medical Sciences*, July, 1904).

Etiology. — Among the predisposing causes age must be placed first. The disease is rare under one year, but I have seen an undoubted attack of scarlet fever in an infant of one week. Up to five years the susceptibility steadily increases and reaches its maximum; after eight years it rapidly decreases, and is slight during adult life. Sex does not influence its occurrence.

That scarlet fever is an infectious disease does not admit of doubt, but the specific germ has not yet been discovered. It has, however, been fully demonstrated that streptococci play an important rôle in the causation of many of the symptoms. It has been urged by some that streptococci are the cause of the disease itself, but this ground is untenable. They are, however, the cause of the pseudomembranous exudations of the throat, and undoubtedly cause the otitis, and adenitis, and probably the nephritis, pneumonia, and joint lesions.

Traumatic scarlatina is an eruptive, contagious, and often epidemic disease which seems to be of the same nature as ordinary scarlatina. The infection, however, occurs in a wound. The disease has been called surgical scarlatina. In

147 cases selected from the literature 117 occurred in children under 15 years of age and two-thirds of these were in boys who had suffered from traumatism. In a number of these cases the appearance of the scarlatina and the association of the wound have been purely coincident. In a certain number, however, the scarlatina has developed in the wound. Traumatic scarlatina is less severe in its course than the ordinary scarlet fever. The eruption makes its appearance at the wound and spreads from that point over the body. The sore throat is very much less severe and the constitutional symptoms slighter. R. de Bovis (*Semaine Médicale*, Jan. 29, 1902).

Whatever the cause of the primary disease may be proved to be, it is certain that streptococci are the direct cause of the secondary symptoms. They are so constant in their presence and so active in the production of the more serious symptoms and complications that they must be regarded as important factors in the production of the clinical picture which we know as scarlet fever. The disease as it commonly appears is a mixed infection, the more malignant and fatal symptoms being due not so much to the primary as the secondary infection. Staphylococci and diphtheria bacilli are sometimes found in conjunction with the streptococci.

The crescent-shaped germ described by Wynkoop and the diplococcus of Class are different forms of the same germ. Examination of 3600 to 6000 cultures from inflamed throats have shown that fully 80 per cent. of the cultures contain this coccus. W. K. Jaques (*Jour. Amer. Med. Assoc.*, May 26, 1900).

The micro-organism discovered by Baginsky and Sommerfeld in the throat secretions and blood of scarlet-fever patients is identical with the diplococcus scarlatinæ personally discovered. The only essential difference is that they speak of it as a streptococcus growing on agar, which is not the case. W. J. Class (*Lancet*, Sept. 29, 1900).

The writer has found in 4 cases of scarlet fever certain bodies which in their morphology strongly suggest that they may be various stages in the developmental cycle of a protozoan. They occur in and between the epithelial cells of the epidermic and free in the superficial lymph-vessels and spaces of the corium. The great majority of the bodies vary from 2 to 7 microns in diameter, and stain delicately but sharply with methylene blue. They form a series of bodies, including the formation of definite rosettes with numerous segments, which are closely analogous to the series seen in the asexual development (schizogonia) of the malarial parasite; but, in addition, there are certain coarsely reticulated forms which may represent stages in sporogonia, or be due to degeneration of other forms. The bodies were not found in the blood, lymph-nodes, or any of the internal organs. The possibility of these bodies being artefacts or degenerations can be effectually excluded. If they are protozoa they must have some causal relation to scarlet fever; for were they normal or occasional inhabitants of the skin, their presence could hardly have been overlooked in the extensive work which has been done on the skin. Though the author believes that these bodies are protozoa and have an etiological relationship to scarlet fever, he does not claim that such a relationship has been absolutely proven. He proposes the name of "cyclaster scarlatinalis" for the organism. Mallory (Jour. of Med. Research, vol. x, p. 483, 1903).

Streptococci and staphylococci are to be found in the throat in the vast majority of cases of scarlet fever. It is significant to note that streptococci are present in a very large percentage of apparently healthy throats. Both organisms are undoubtedly frequently concerned in the complications of scarlet fever, but are not to be looked upon as the specific agent.

The diplococcus described by Class as the cause of the disease was found by the authors in but a comparatively

small percentage of cases, and they cannot regard this organism as bearing any etiological relationship to the disease.

The interesting findings of Mallory, of protozoa-like bodies in the skin of scarlet fever patients, will doubtless stimulate research along these lines. It is quite possible that the failure in the past to discover the contagium vivum of the disease has been due to the fact that almost exclusive search for vegetable parasites has been made. J. F. Schamberg and Nathaniel Gildersleeve (Medicine, Sept., 1904).

Experiments seem to show that the specific germ of scarlet fever exists in the blood, for inoculation with the serum into susceptible animals produces a typical attack of the disease. It is, also, found in the various secretions, as shown by their power to generate the disease.

The micro-organism, while more tenacious of life than is that of most other diseases, either lacks the power of gaining a foothold, when implanted in the system, or is less readily conveyed through the air. It is at least a fact that many more children escape scarlet fever than measles, and its spread is more readily controlled.

The chief source of infection is the patient himself, but the area of contagion is limited to a few feet. The desquamation-scales are extremely infectious. Their retention by clothing, bedding, and the walls of the rooms is one of the most common causes of infection. The purulent secretions from the throat, nose, and ear are also very infectious.

The bacteria obtained from cultures from the skin, epidermal scales, and the surface of the tonsil in cases of scarlatina are the same as those found in the same locations in health, and not one of them is constantly present except the streptococcus in the throat. Because the numerous cocci which grow in such cultures, and which appear in groups of two and four or bunches of the same

under the microscope, it is impossible to identify them, except by a complete study in pure culture. Cultures made by inexperienced persons or by those who do not fully appreciate the importance of avoiding the tongue, are especially apt to contain large diplococci or sarcinæ. The streptococcus is present upon the tonsil of scarlatinal patients in enormous numbers in almost all cases. G. H. Weaver (Amer. Medicine, April 18, 1903).

Desquamation is not a manifestation of scarlet fever alone, and although more complete in this disease, yet the more moderate peeling of measles and röteln has not been considered as being of a specially infective character. The similarity between scarlet fever and diphtheria seems to point to an infective organism for the former similar in character to that of the latter. In each disease the tonsils and soft palate are the parts usually affected first. The tonsillar and buccal mucus is the home of the diphtherial contagion, and it would seem probable that the same secretion is ordinarily the habitat of the scarlet fever virus; fever hospitals which have taken to discharging patients before desquamation has ceased have not shown any increase in the "return" cases. L. C. Parkes (Practitioner, Apr., 1903).

Scarlet fever is spread by indirect infection more frequently than any other disease except diphtheria. Its specific micro-organism is more tenacious of life than that of any other disease, except, perhaps, small-pox. Authentic cases have been reported in which it maintained its vitality for a year or more. It may be conveyed from one child to another in the fur of cats and dogs, and it is probable that these animals may suffer from the disease. The contagion clings to rooms with great tenacity, being usually lodged in the wall-paper or in cracks of the walls, ceilings, and floors. The conveyance of scarlet fever by milk and other articles of food is undoubted.

The celebrated epidemics of Hendon and Wimbledon were believed by Dr. Klein to be due to scarlet fever in the cows, but this belief has not been substantiated. It is probable that the disease from which those cows suffered was not true scarlet fever. The disease has been conveyed by letters written by hands in the stage of desquamation. An attendant upon a case of scarlet fever may easily carry the infection to other children by the cloths, hands, or beard.

Streptococci always found in the tissues and blood of scarlatinal cases. In not one of the many cases investigated at necropsy were the streptococci absent from the cardiac blood and the bone-marrow. Cultures taken from the membrane of patients with scarlatinal angina showed streptococci, admixed with pneumococci, leptothrix, etc.; in only 5 per cent. of the cases were they associated with the Klebs-Löffler bacillus. As to their morphology, which is of a distinctive character, the streptococci form chains of varying length. The single coccus is round, but frequently is flattened at right angles to the axis of the chain; examined closely it often resembles a diplococcus, but its morphology is subject to considerable variation. When subjected to the action of blood taken from patients convalescing from scarlatina, these streptococci failed in every instance to give the agglutination reaction. Baginsky and Sommerfeld (Archiv für Kinderh., Jan., 1902).

The portal of entrance in most cases is undoubtedly the naso-pharynx. It is here that the first local symptoms appear, and all the evidence points to the fact that both the primary and secondary micro-organisms commonly enter the system at this point.

In cities scarlet fever is endemic, a few cases appearing in the health reports every week, but at intervals it becomes epidemic, usually during the fall and winter. Epidemics of scarlet fever usually spread very slowly as compared with those of measles

PERIOD OF INCUBATION.—The period of incubation is shorter than that of any other infectious disease, except, perhaps, grippe and diphtheria. The extremes range from a few hours to fifteen days. In 87 per cent. of cases Holt found the period to be less than six days and in 66 per cent. between two and three days.

PERIOD OF INFECTION.—The period of infection is long. The disease is not infectious during the period of incubation, but it may be so from the first appearance of changes in the throat. The most actively-contagious period is at the height of the febrile stage: on the third, fourth, and fifth days. The infectious power then diminishes, but increases again during the stage of desquamation. The period of contagion continues until the last evidences of desquamation have disappeared. The purulent discharges from the throat, nose, and ears are capable of infecting others, and isolation should not be relaxed until they have disappeared. The conventional forty days is not too long. It should be as much longer as the condition of the skin and mucous membranes may indicate.

Four thousand nine hundred and ten cases of scarlet fever collected, of which 158, upon their return home, appeared to have carried infection and to have caused 171 new cases. The greater proportion of infection occurred during the first week, and diminished quite rapidly until the sixth. As these cases were isolated for an average period of 8.3 weeks from the initial symptom, it appears that this period is insufficient. Of these cases, those that were isolated for more than 9 weeks conveyed less than half as much infection as the others. The so-called return cases are usually of the severe type. The source of infection may be either the nasal discharge, the discharge from the ear, or the desquamated skin. C. K. Millard (Brit. Med. Jour., Sept. 3, '98).

Pathology.—In uncomplicated scarlet

fever the lesions are confined to the skin and throat. The lesions of the skin are those of acute dermatitis. The papillæ and the stratum beneath become infiltrated with fluid, while about the blood-vessels there are aggregations of leucocytes. The production of epithelium is greatly increased during the acute stages, which result later in profuse exfoliation of the superficial layers. In the later stages in addition to this, according to Neumann, there is also a profuse development of exudative cells, particularly among the ducts and follicles. These cells easily reach the epithelial surface: a fact which accounts for the great infectiousness of the desquamating cells.

The throat changes in uncomplicated scarlet fever are catarrhal in nature, and are an essential part of the disease. The croupous and diphtheritic membranes must be considered as complications.

COMPLICATIONS AND SEQUELÆ.—*Angina.*—Except in a very few mild cases, the throat always shows some pathological change. A catarrhal condition of the throat is normal to scarlet fever, but membranous exudates and gangrene are not essential to it.

The true nature of the membranous inflammation seen in scarlet fever was long a subject of discussion, which has been settled by the bacteriologist. With few exceptions, the angina of the early stages is pseudodiphtheria, that of the late stages true diphtheria. While primary pseudodiphtheria is a mild disease, the death-rate being rarely over 5 per cent., secondary pseudodiphtheria is very dangerous and fatal. The membrane may appear on the throat on the first or second day, but it is not usually seen before the third day. It is generally confined to the tonsils, but frequently fills the throat and naso-pharynx. It shows a tendency to invade the ears and nose and

to shun the larynx. It reaches its height about the sixth or seventh day. It frequently presents all the local characteristics of diphtheria together with the general symptoms of septicæmia. The exciting cause of this membranous inflammation is the streptococcus pyogenes. It is occasionally associated with the staphylococcus aureus or albus, but the streptococcus is the more commonly observed. It occurs not only in the pseudomembrane and the tissues underneath it, but is found in the blood in large numbers. Through the agency of the toxins which it generates it is unquestionably the cause of the complications and general septicæmia. The pseudomembranes which appear late in the disease are usually associated with the Klebs-Loeffler bacillus. Diphtheria is, in the fullest sense of the word, a complication, and is not an essential symptom of scarlet fever.

Otitis, next to angina, is the most common complication, and in its results is one of the most serious, as it is a common cause of deaf-mutism. It results from extension of the inflammation from the throat through the Eustachian tubes. The tendency to ear involvement varies in different epidemics, but it is more common in young patients. It does not usually occur until the second week, and, as a rule, involves both ears. Its presence may be indicated by earache and an increase in the fever, but frequently a discharge is the first indication that the ears are involved. The process is prone to be a destructive one and to result in long-continued suppuration. It sometimes leads to a rapidly-fatal meningitis.

Adenitis and cellulitis are common results of streptococcic invasion of the throat. Not only are the lymphatic glands themselves enlarged, but there is

more or less inflammatory œdema of the surrounding tissues. That this is due to secondary infection is shown by the fact that streptococci are found in abundance in both the nodes and œdematous tissues around them. Enlargement of the nodes may be detected during the first week, but serious cellulitis does not, as a rule, occur until later in the disease. Suppuration, sloughing, or even gangrene may occur.

Joint Lesions.—Although acute articular rheumatism sometimes occurs, the joint affection often called scarlatinal rheumatism is, in most instances, a synovitis. It is mild, and is frequently confined to the wrist. It appears early in the second week, continues for three or four days, and disappears, suppuration being rare. It is seldom seen under four years. Pyæmic arthritis occurs in extremely rare instances, and affects the larger joints, the lesions being multiple. Marsden has recently offered the following excellent classification of the scarlatinal joint lesion: (a) synovitis, (b) acute or chronic pyæmia, (c) acute or subacute rheumatism, and (d) scrofulous disease of the joints.

Nephritis.—Albumin may be found in the urine during the acute stage; but it is febrile albuminuria, due to degenerative nephritis, which subsides as the temperature falls. In the grave type kidney lesions may occur, to which the term septic nephritis has been given. The urine contains albumin, but blood and casts are not necessarily present, neither do the rational symptoms of uræmia appear.

The most characteristic and common kidney lesion is post-scarlatinal nephritis, and is a diffuse nephritis. It develops during the third or fourth week, and may follow a severe or mild attack. There may be no interval of apyrexia between

the kidney attack and the onset of the nephritis. It may be so mild as to almost escape notice, or it may be so severe as to cause speedy death. Recovery may be complete or incomplete. The first symptom to be noticed is usually œdema of the face, which is frequently accompanied by feverishness and restlessness. Dropsy and all the characteristic symptoms of acute nephritis rapidly develop. The urine usually shows a small amount of albumin for a few days before the advent of definite symptoms. As the disease develops, the urine becomes scanty and high colored, and may be completely suppressed. It contains a large amount of albumin, and is loaded with blood-cells and casts. The first evidence of albumin after the second week should be a warning of danger, and should receive immediate attention.

In the majority of 90 cases of scarlet fever there was acute hæmorrhagic nephritis. In many of these the other symptoms of scarlet fever were very mild, *e. g.*, the angina—and the diagnosis was rendered difficult in a whole series by the absence or faintness of the eruption. In a large number of instances hæmorrhagic nephritis came on without any preceding disturbances whatever. In other cases the chief symptom was an adenitis, without any or with only a very faint eruption. In some the eruption was morbilliform, but in all, the bacteriological examination of the blood was negative. Acute hæmorrhagic nephritis was found in all these. In one case there was this form of nephritis with suppurative mastoiditis, without any eruption, but other cases of scarlet fever in the family revealed the nature of the disease. Berghinz (*Gazzetta degli Osped. e delle Clin.*, Nov. 1, 1903).

Pneumonia, although commonly found at the autopsy in patients who have died with septic symptoms, is frequently not recognized before death. Endocarditis and pericarditis, though uncommon, are

sometimes encountered. Murmurs are occasionally heard during the course of the disease, which disappear as the active symptoms subside. Permanent organic lesions sometimes develop in conjunction with the late kidney complications. Nervous symptoms are rare. The various serous membranes are occasionally involved. Peculiar attacks of symmetrical, superficial gangrene have been reported. The disease may be complicated by any of the other infectious diseases.

Study of 13 livers from persons dead of scarlet fever. In scarlet fever it is usually increased in volume, pale, often mottled with red or with violet, and presents white or red areas on its surface. The lesions are usually situated near the portal space and have a tendency to surround the lobule. The leucocytes are abundant, and the hepatic cells tend to degenerate in this region. Fatty metamorphosis is the most frequent form of degeneration found. The amount of fat may be twice or three times as much as normal. The most marked and most extensive degenerations were usually found in subacute cases. Roger and Garnier (*Revue de Méd.*, Mar. 10, 1900).

Second attacks of scarlet fever are extremely rare. They sometimes occur, but in most supposed cases there has been some error in diagnosis. Relapses are more common than second attacks. They result from autoinfection, and usually occur during the second or third weeks.

Prognosis.—The younger the patient, the greater the mortality. Holt, after the study of a large number of American and European cases, concludes that the general mortality may be assumed to be from 12 to 14 per cent., while under five years it is from 20 to 30 per cent. It is much lower in private practice than in hospitals. The majority of fatal cases occurs in children under seven years. Prognosis is rendered unfavorable by the appearance of the following symptoms, the gravity being in proportion to their

severity: Violent onset, high temperatures, convulsions, extensive pseudomembranes or gangrenous pharyngitis, diphtheria, croup, pneumonia, excessive cellulitis, superficial gangrene, nephritis, and exhaustion with general septic symptoms. The prognosis in uncomplicated cases, even when the disease runs an active course, is good.

Study of 2627 cases treated during seven years in the Riverside and Willard Parker Hospitals. The mortality-rate was 9 per cent. In the very earliest cases of scarlet fever the eruption is frequently present on the anterior axillary fold. Projectile vomiting is a very common early symptom. In favorable cases the maximum temperature is about 103 degrees. W. L. Somerset (N. Y. Med. Jour., Dec. 8, 1900).

Prophylaxis.—In view of the gravity of the disease and the effectiveness of preventive measures, prophylaxis assumes unusual importance. The most important of all prophylactic measures is complete isolation of the sick. This applies to nurse as well as to patient. If possible, one person should be selected as an intermediary between the nurse and the family. The doctor should always wear in the sick-room a gown of muslin or calico fastened at the neck and wrists and long enough to completely cover his clothes. A stethoscope should be used in making physical examinations of the chest.

The period of isolation should not be less than forty days and as much longer as the presence of desquamation or purulent discharges may demand. Discharges of the patient should be disinfected with strong sublimate solutions. The bedding, carpet, and clothing should be disinfected with boiling water or steam. The mattress should be destroyed. The room itself should be thoroughly washed—floor, ceiling, and walls—with a 1 to 2000 sublimate solution.

One room on the top floor of every house should be arranged for a sick-room: the moldings should be plain and the floor of hard wood; the walls and ceilings should be painted or covered with washable paper; the bedstead should be of enameled iron. It is a fallacy to suppose that dishes in the sick-room, filled with antiseptic fluids, can limit the spread of the disease, or that there is any efficiency as a prophylactic in generating steam impregnated with medicinal agents. Their use is liable to generate a false sense of security and lead to the neglect of more important measures.

The most reliable prophylaxis of scarlet fever is isolation of patients and nurses and thorough use of disinfectants in their rooms and on their persons. All articles not absolutely needed should be removed from the sick-room, and no one except nurses and physicians allowed to enter. Constant ventilation should be insisted upon. Clothing used about the patient should, on removal from the sick-room, be placed in a tub of boiling water containing carbolic acid and sulphate of zinc, or in corrosive-sublimate solution 1 to 1000, and allowed to soak at least an hour; then placed in boiling water for washing. Vessels used by the patient should have a disinfecting fluid constantly in them, and be cleansed with boiling water immediately after using. Water-closets should be disinfected daily with lime or sulphate of zinc. Sterilized cloths should be used in place of handkerchiefs, and burned after using. During desquamation the patient should be kept well anointed with carbolized vaselin or lysol and vaselin. The physician also should anoint his hands and face and put on a close-fitting gown and hood before entering the room, and should wash and disinfect his hands and face and put the gown and cap in a bag containing a sponge saturated with formaldehyde before leaving the house.

After convalescence, the room and everything which has been exposed should be thoroughly disinfected, and feather or straw beds, or other things

which cannot be thoroughly disinfected, should be burned. Formaldehyde is probably the best, safest, and cheapest disinfectant in use. N. D. Coxe (*Sanitarian*, Aug., '97).

Treatment.—Many specifics for scarlet fever have been proposed, tried, and found wanting. Much may be done to avert complications and to render them less serious when they occur, and many lives may be saved by judicious management. Mild cases require little or no medication; they usually receive too much.

The patient should be kept in bed for at least three weeks, and should receive a fluid diet for not less than two weeks. Milk is the best diet for scarlet-fever patients. It may be given peptonized or plain. Later in the disease broth, eggs, or meat-jellies may be given. The stomach should never be overfilled.

The initial vomiting usually requires no treatment, but the bowels should be acted upon mildly by small, repeated doses of calomel. Later they should be kept acting, if possible, by means of enemata rather than by the use of cathartic drugs.

In severe cases stimulants are required. In malignant cases they should be pushed to the point of tolerance. Strychnine is of great value in septic cases with prostration; it may often be combined to advantage with digitalis. Bathing the surface with warm water followed by anointing with plain or carbolic vaselin or a 5-per-cent.-ichthyol ointment should be begun as soon as the first signs of desquamation appear and should be continued throughout the course of the disease.

The throat symptoms of the first few days may be mitigated by giving cool water or bits of ice. Later hot drinks may be given or irrigation of the back

of the throat with a weak hot saline or boric-acid solution may be employed. Chlorate of potash should be avoided. Its beneficial effects are doubtful and its known irritating effect upon the kidneys contra-indicate its use. Nasal syringing should be avoided unless clearly indicated by a purulent nasal discharge or obstruction of the naso-pharynx. More harm than good may result from overzealous attempts at local treatment of the throat and nose. The most successful treatment consists in the use, not of active and poisonous antiseptics, but of mild and cleansing washes, freely and frequently applied.

Adenitis can only be controlled by checking the septic process at its fountain-head in the throat. The application of hot oil or the hot-water bag is soothing to some patients, but the use of cold is preferable in most cases. Poultices should not be applied continuously. Diffuse suppuration requires free incision. Otitis requires the treatment demanded by the disease in other conditions. The joint affections require but little treatment other than rest and protection. Rheumatism should receive its own appropriate treatment. Restlessness and nervous symptoms are sometimes relieved by cold to the head or by the use of small doses of phenacetin, not enough being given to materially affect the temperature. Nephritis should receive prompt and very careful attention. Its treatment is that of nephritis due to other causes.

Only those diuretics should be used in nephritis of scarlet fever which do not irritate the kidney. Acetate of potassium is one of the safer diuretics in this complication. In severe cases, with general œdema and threatening uræmia, cathartics are rather more certain in their action than diaphoretics and diuretics, and are especially indicated where, as is usually the case, constipation is present. Podophyllin in doses of $\frac{1}{10}$ grain may be

given to a child five years old, and be repeated a number of times. It usually acts quickly. The compound jalap powder, in doses of from 5 to 10 grains, may also be given where a rapid and decided derivation by the intestine is indicated.

If the skin is hot and dry and uræmic symptoms (usually represented by anuria, somnolence, amblyopia, and headache) are present, we may resort to the hot pack, either wet or dry. The child should be wrapped in a blanket and placed directly in a tub containing water at a temperature of from 105° to 110° F. The child should be kept in the water fifteen or twenty minutes, or even longer if necessary, and should then be taken from the wet blanket, enveloped in hot, dry blankets, and kept in them until the skin has become moist and reaction has taken place. While the child is in the bath milk may be given to it, and stimulants if they are indicated by a weak or an intermittent pulse.

In addition to this treatment, hydrochloride of pilocarpine, in doses of $\frac{1}{20}$ grain, should be given by the mouth to a child of two years, and subcutaneously if desired to a child five years of age. In these cases of threatened uræmia convulsions sometimes appear quite suddenly. Under these circumstances enemata of hydrate of chloral, from 5 to 10 grains dissolved in water, are of value in controlling the nervous phenomena. The author prefers, however, to use a combination of bromide of potassium and hydrate of chloral.

Where the ascites is extreme, paracentesis abdominis is often of great value, not only in relieving the pressure, but also in increasing the action of the diuretic, which perhaps before was not acting freely. Digitalis is a valuable remedy, especially adapted to the treatment of the nephritis of scarlet fever and to that of the cardiac changes which result from it. By the administration of this drug the flow of urine is increased. It is best given in the form of a freshly-prepared infusion, in teaspoonful doses every four hours, to a child five years old. Diuretin, 5 grains dissolved in water and given two or three times in the twenty-four hours, has proved of

considerable value. Nitroglycerin is valuable where the action of the heart suddenly becomes feeble and irregular. T. Rotch (Boston Med. and Surg. Jour., May 27, '97).

Acetanilid is useful for relieving the severe headache and the joint pains, but phenacetin is better when much muscular pain is present. If the pulse denotes high arterial tension, antipyrine should be prescribed; no harmful effects from it have been noted, even in the youngest infants, if given in doses of $\frac{1}{4}$ grain. To relieve internal congestion, particularly of the kidneys, a decoction of scoparis, and also such cholagogues as cascara and sodium phosphate, are of value. Solomon (Phila. Med. Jour., July 1, '99).

The methodical use of intestinal irrigation with physiological saline solution is an important adjunct. It increases diuresis and militates against or prevents uræmic symptoms. Wertheimher (Klinisch-therap. Woch., No. 11, 1900).

The use of oxygen-gas advocated in scarlatinal nephritis. Besides being a good cardiac stimulant, it materially assists in eliminating toxins. Another useful measure is enteroclysis, using a saline solution at a temperature of 110° to 120° F. for fifteen to twenty minutes at a time, three or four times a day. As a rule, from three to five times as much urine is secreted as the quantity of saline solution introduced. R. C. Kemp (Archives of Pediatrics, July, 1900).

To ward off nephritis, an absolute milk diet should be given for ten or twelve days. During the eruptive period the child should be bathed in tepid water; and after desquamation has begun inunctions of antiseptics are indicated. The ichthyolized vaselin, recommended by Seibert, of New York, is excellent.

Boricated or resorcinated vaselin should be applied to the anterior nasal chambers, while spraying mentholized oil into the nasal passages is of importance. The throat should be kept clean by copious lavage with boiled water, rendered alkaline and antiseptic by boric acid, resorcin, etc. After the lavage the throat should be brushed by

stronger applications of the same antiseptics.

Calomel and salol are of value to disinfect the gastro-enteric canal. For the adynamia saline solution, ether, or camphor should be injected. Aviragnet (*Le Bull. Méd.*, Mar. 23, 1901).

According to the researches of the Pasteur Institute, the saliva possesses the greatest toxilytic power of all the secretions and is poured out in the locality where the scarlatina toxins are formed. Hence pilocarpine is the most valuable single agent against scarlatina and its associated affections. It should not be given in immediate conjunction with the coal-tar antipyretics, and each dose is better preceded by bathing. Chloral is nearly always indicated in small, frequently repeated doses. In case of disagreeable effects from pilocarpine, a hypodermic of atropine, the "physiological antidote," will protect the patient. Toleration is rapidly established. A great gain is in the prevention of parched mouth and lips. E. W. Saunders (*Archives of Pæd.*, Feb., 1903).

To avoid scarlatina nephritis, the writer has used urotropin in 102 cases. The dose is graduated according to the child's age and varied from $\frac{3}{4}$ to 7 grains. In the 102 cases there was not a single case of nephritis, although this complication occurs according to Johannessen in 16 per cent. of the cases. Widowitz (*Wiener klin. Wochen.*, No. 40, 1903).

The temperature may require attention from the outset, but it should not be forgotten that a high temperature is normal to scarlet fever. It may be allowed to run, therefore, without interference, to a somewhat higher point than in most other diseases. Hyperpyrexia, or a temperature continuously above 104° , demands treatment. It is best reduced by means of the cold bath; but this, for obvious reasons, is less practical in private than in hospital practice. The cold pack or cold sponging are more available. An effective method of applying cold adopted at the Willard Parker Hospital

is thus described by Northrup: "The tendency in all cooling processes is for the feet to become cold. To obviate this the patient is placed upon blankets, but the legs, feet, arms, and hands are wrapped in warm, dry blankets, and hot bottles are inclosed in the wrappings. An ice-bag is applied to the head. The face and trunk are freely sponged in warm water and alcohol, evaporation being hastened by fanning, so long as it cools the patient, clears the cerebrum, gives force and improved rhythm to the heart, and leaves the patient to a quiet sleep." Great caution should be exercised in the use of antipyretic drugs. The coal-tar antipyretics are capable of doing much harm if injudiciously administered.

Coal-tar products should not be used in reducing temperature in scarlatina. Digitalis seems better than strophanthus in heart-complication, and copious draughts of water are best for flushing out the kidneys. J. H. McCollom (*Phila. Med. Jour.*, June 3, '99).

When there is high temperature in the early part of the disease and severe nervous symptoms, an excellent method consists in putting the child in water at 90° F., sufficient to cover the body and extremities. A large wash-boiler or tub will generally suffice and has generally been used in personal cases. The child should be constantly rubbed while in the water. The patient is to remain in the bath about eight minutes, dried quickly, and put to bed without taking time to put on a night-gown or other clothing. D. S. Hanson (*Columbus Med. Jour.*, Aug. 5, '99).

A 5- to 10-per-cent. ointment of ichthyol in lanolin in scarlatina since 1884. The ointment is applied once or twice daily, in such a manner that the whole body is covered and the ichthyol is rubbed into the skin until hardly any ointment remains on the surface. The skin of the patient assumes a brownish hue after the inunction, which is made with the tips of the fingers.

The swelling of the skin is reduced after the first inunction. The pruritus, which is excited by the ichthyol, disappears quickly. The occurrence of ulceration and phlegmonous and erysipelatous infiltrations in the skin is prevented. A. Seibert (*Jahrb. f. Kinderheilk.*, Mar., 1900).

Temperatures of 103° to 106° F. in scarlatina and measles decline promptly by one or more degrees from an injection of a pint or more of cool water containing 2 to 10 grains, according to age of patient, of sulphocarbolate of soda per rectum. In the same conditions and even in the same cases the cold bath has not acted with so much or so happy effect. When the enema has been ejected without accomplishing a movement of the upper bowel, melioration of temperature has nevertheless been noted.

High post-eruptive temperatures are often and have been repeatedly traceable to infelicities of ingestion and digestion, and are more effectively relieved by prompt and sufficient enemas than by any other treatment.

These high post-eruptive temperatures repeatedly rising in the same individual have been accompanied synchronously by sensible increase of submaxillary swelling and tenderness, followed by the quick abatement of these lymphatic swellings, along with the reduction of temperature from cooling antiseptic enemas. Arthur de Voe (*Pediatrics*, Aug. 1, 1901).

Antistreptococcic serum has been tried several years now as rational treatment for scarlet fever, and some favorable results have been reported from its use. At the present writing, however, very little is actually known of the treatment, and no expression of opinion is possible. As the more serious symptoms are due to streptococcic infection, the theory underlying this treatment is not irrational.

Antitoxin used in 25 cases, some of them very severe, as curative agent, and also as immunizant for the children in other families where the disease occurred. None of the immunized children had the disease, and not a single death

occurred among the patients. A number of cases that were running a severe course at once assumed a mild form after one or more hypodermic injections of antitoxin. C. U. Dalton (*Merck's Archives*, May, 1901).

Streptococci in the throats of 696 out of 701 children examined. In 100 cadavers examined after death from scarlet fever streptococci were found in the organs, blood, marrow, etc., in all cases. Personal belief, therefore, that streptococci are the cause of scarlet fever. Marmorek's serum tried, but found useless. A serum was employed which had to be prepared by utilizing cocci obtained from the bone-marrow of patients who had died from scarlatina. The serum conferred protection upon mice from virulent cultures, while the control mice and those pre-treated with Marmorek's serum succumbed. The case-mortality in a series of 58 patients treated with the serum was slightly lower than in another group of 63 patients treated in the usual way. Impression obtained that the serum was beneficial. The temperature fell slowly after the injections and did not rise again. The affection of the fauces generally disappeared rapidly, and, although a fair number of complications occurred, this could be fairly attributed to the severity of the attacks. The serum did not appear to have the powerful action which is seen in diphtheria antitoxin, but has an action which, although slow, is lasting and continuous. The serum prepared by Aronson is worthy of a careful trial. A. Baginsky (*Berliner klin. Wochen.*, Dec. 1 and 8, 1902).

A great deal has been said of late about the serum-treatment of scarlet fever, and much of what has been said has been indicative of confidence in the actual or rapidly approaching achievement of success with the treatment. Of all the recent publications on the subject, those of Prof. Adolf Baginsky, of Berlin, have probably attracted most attention. A letter from Dr. Baginsky, recently received by the *Journal* states that he is not at present prepared to make any stronger statement than he has already published. In this letter he

emphasizes the fact that the credit of preparing the serum most recently and promisingly used by him is due solely to Aronson. While there are very encouraging indications that we are in a fair way to possess an efficient scarlet-fever antitoxin before long, it would still be premature to proclaim its actual existence. Editorial (New York Med. Jour., March 14, 1903).

As emaciation and anæmia are frequent results of scarlet fever, active tonic treatment should be instituted during the convalescence, the chief reliance being placed upon iron. Basham's mixture is especially indicated. The patient should be particularly protected from cold, for exposure not infrequently seems to precipitate nephritis long after its usual period of occurrence.

Compulsory notification, accompanied by hospital treatment, has lowered the mortality of scarlet fever and altered the type of the disease. Epidemics are now characterized by a want of symptoms and signs. The bright-red rash is seldom seen, and it often disappears before the arrival of the medical attendant. The throat signs, too, may be transitory. It is these mild cases, however, that kindle into flame the big epidemics in large towns. William Robertson (Brit. Med. Jour., Apr. 6, 1901).

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SCLERODERMA.

Definition. — A disease characterized by induration of the skin, and at times of the subcutaneous tissues, which sometimes progresses to complete atrophy of these tissues.

Varieties. — Three main varieties of scleroderma are recognized: the *diffuse*, which is generalized or limited to certain areas; the *circumscribed*, or morphea, which appears in spots; and *sclerodactyly*, which is limited to the hands.

Symptoms. — In the diffuse form, after a series of prodromic symptoms, sensa-

tions of chilliness or heat, pruritus, and pain in the muscles and articulations, the tissues become thickened, stiff, and hard, and appear œdematous. The skin is cold and whitish, contracted, and sometimes painful. The face and the upper part of the body may be the only parts affected, but the entire body becomes involved. The skin is, as it were, glued to the skeleton, the fingers and toes being thin and stiff or hooked. Gangrene is sometimes observed, constituting the mutilating form. The prognosis is exceedingly unfavorable as regards cure.

In the circumscribed variety, the morphea of Erasmus Wilson, the affected spots are limited in area, the spots being flat or raised, oval or rounded. Their color varies from a light pink to a pale or dark violet, and undergoes changes which ultimately give the lesion a characteristic aspect: a whitish-brown squamous centre surrounded by a bluish or lilac pigmented border, or ring. They are seldom painful, though pruritus is sometimes complained of. The spots, of which there are generally but two or three, are usually located upon the neck, the chest, the abdomen, the arms, or the thighs. These spots gradually fade away, but, occasionally, cicatrices are left to mark the location of the lesions. The prognosis in this form is favorable.

In sclerodactyly the third phalanx becomes atrophied and its tissues, including the nail, are partially destroyed by abscess. The flexor tendons are contracted and give the finger the appearance of an angular hook by flexing the first phalanx upon the second. Here also the skin is hard, contracted, adherent to the bones, and lilac in color. The prognosis is necessarily unfavorable, owing to the mutilations caused by the disease.

Diagnosis. — The only condition with which scleroderma can be easily con-

founded is leprosy, but the tubercles of the latter disease, the broad dissemination of the skin-lesions, the nasal disorder, the character of the ulcerations, and the disturbances of sensation usually facilitate its recognition.

Diffuse scleroderma must sometimes be distinguished from brawny, solid œdema, met with at times in patients with long-standing renal or cardiac disease, in which there is induration following chronic dropsy. In scorbutic sclerosis there may be parchment-like immobility of the skin, due to extensive subcutaneous hæmorrhages, involving the muscles. In the stage of swelling it may resemble myxœdema. In Raynaud's disease the infiltration, pigmentation, and extreme cyanosis are not wholly unlike those of scleroderma. The increase of pigment may suggest Addison's disease, since the bronzing may be extreme. Osler (*Jour. Cutan. and Genito-Urin. Dis.*, Feb., Mar., '98).

Case of diffuse scleroderma in a man of 41 years with total atrophy of the thyroid gland and bronzing of the skin. The scleroderma affected the hands, the face, the chest, the abdomen, and the lower extremities. Sensation, both for temperature and pain, was normal; the electrical reactions were practically unchanged; the sweat-secretion was not disturbed. Atrophy of the thyroid gland has been found in other cases of scleroderma, but it was generally secondary; in this case it seemed to precede the skin-changes. Uhlenhuth (*Berl. klin. Woch.*, Mar. 6, '99).

Etiology and Pathology.—Scleroderma is a trophoneurosis, most frequently observed among neurotic subjects and often in connection with the rheumatic diathesis. It may appear at any age, but is more prevalent among women than men. The neurotic influence, however, does not account for all cases, nerve-changes being wanting in the majority. Kaposi notes that the lesions follow, to a degree, vascular distribution. The morbid changes peculiar to scleroderma

include an endoperiarteritis, which may be traced to various structures, the muscles, the myocardium, the uterus, the lungs, and the kidneys particularly. The sclerosis would thus seem to be a result of the vascular disturbances, through impaired nutrition of the affected areas.

Treatment.—The treatment consists in nutritious diet, iron, and codliver-oil in ascending doses (the latter up to 10 tablespoonfuls per day); sodium salicylate; externally, steam-baths, mud-baths, mercury, galvanism, and massage. The most recent remedy is thyroid gland; but, according to Osler, it is not of much value. Brocq recommends electrolysis, at first at comparatively short intervals; then, when amelioration is manifest, at much longer intervals. Electrolysis does not act by destructive action, but at a distance, influencing even patches not touched. Philippsohn obtained excellent results by the administration of salol, in doses of about 7 to 15 grains, three or four times daily.

SCLEROSIS OF THE BRAIN.—Sclerosis of the brain is a condition which results from a chronic inflammation of the cerebral tissue, which inflammation may arise primarily in the connective tissue or secondarily by extension or contiguity, and is analogous in many respects to that inflammatory action which is associated with cirrhosis of the liver. The connective tissue of the brain is of two distinct varieties, one of which, the neuroglia, is derived from the ectoderm and forms the net-work or mesh which holds together the central nerve-cells and ganglia of the brain-substance proper; the other, derived from the mesoderm, forms the basic substance of the meninges and the sheaths and supporting structure of the blood-vessels, being identical with the ordinary fibrous

or connective tissue found elsewhere throughout the body. Both varieties are concerned in this process of sclerosis (induration or hardening).

Osler suggests a convenient division of the cerebro-spinal scleroses, from an etiological stand-point, into degenerative, inflammatory, and developmental forms.

Under the head of degenerative forms he includes: (a) the common degeneration which follows when nerve-fibres are cut off from their trophic centres (the severance of portions of neurons from the main portions containing the nuclei); (b) toxic forms following poisoning by lead, ergot, syphilis, etc.; (c) the scleroses associated with senile changes in the smaller arteries and capillaries in the convolutions. Some forms of insular sclerosis (*sclérose en plaques*) are probably due to primary alterations in the blood-vessels; it is not proved, however, whether these cases are caused by impaired nutrition resulting from lesions of the capillaries and smaller arteries, or whether the lesion is a primary degeneration of the nerve-cells and fibres to which the sclerosis is secondary.

The inflammatory scleroses include secondary forms which develop in consequence of irritative inflammation about tumors, foreign bodies, hæmorrhages, and abscesses. These are chiefly vascular (mesodermic) scleroses, arising from the connective tissue about the blood-vessels. A similar change may possibly follow the primary, acute encephalitis, which Strümpell holds is the initial lesion in the cortical sclerosis found in infantile hemiplegia.

Osler's third group, the developmental scleroses, are believed to be purely neuroglial (ectodermic) in character, and embrace the new growth about the central canal in syringomyelia; the sclerosis of the dorsal columns in Friedreich's

ataxia; and, perhaps, the congenital diffuse cortical sclerosis without thickening of the meninges. If both the ectodermic and mesodermic connective tissues be involved, the resulting sclerosis will be of a mixed character.

When considered by their appearance, distribution, and anatomical formation, cerebral scleroses are known as miliary, diffuse, tuberos, and insular scleroses.

Miliary sclerosis is a name for several different conditions. In one variety there are small nodular projections, varying from one-half to five or more millimetres in diameter, upon the surface of the convolutions; single nodules are not uncommon; they may be found sometimes in great numbers. Gowers reports a case in which grayish-red spots were found located at the junction of the white and gray matters; the neuroglia was in an hypertrophic condition.

Diffuse sclerosis may involve a single lobe (*sclérose lobaire*) or an entire hemisphere. This condition occurs most frequently in idiots and imbeciles. In extensive cortical sclerosis of one hemisphere the ventricle is usually dilated (Osler). The region affected and its extent will determine the symptoms, although there may be no symptoms and but little noticeable impairment of the mental powers. There is, in the majority of cases, hemiplegia or diplegia, with idiocy or imbecility.

Tuberos sclerosis, also known as hypertrophic sclerosis, is applied to a condition in which there are opaque, white, firm, projecting areas located upon the surface of the convolutions, which may not affect the symmetry of the convolution, but give it an increased size and density and a change in color.

These three forms are only of interest to neurologists and alienists.

Insular sclerosis, or *sclérose en plaques*, is defined by Osler as a chronic affection of the brain and cord in which the nerve-elements are more or less replaced by connective tissue. It may occur in the brain or cord alone, but is more commonly found in both.

Symptoms.—According to the varying location of the foci, the symptoms may be, to a certain degree, variable, and the majority of the classical symptoms may be absent. The development of the disease is slow and the course is chronic. Feebleness of the limbs, with irregular pains and stiffness, is the earliest symptom. The resemblance is sometimes very close to spastic paraplegia with great increase in the reflexes.

Later three important symptoms appear: volitional tremor, or so-called intention tremor; scanning speech; and nystagmus.

Volitional tremor is a trembling that comes on when muscular action is attempted. The tremor may be noticed in the extremities or head. When the patient is quiet the tremor disappears.

By scanning speech is meant that in reading or speaking each word is pronounced slowly or separately, or each syllable may be accentuated. This is a common feature. Nystagmus, a rapid oscillatory movement of the eyeballs, generally horizontal, is an important symptom. Optic atrophy, though not so frequent as in tabes, is sometimes present. The sphincters are usually unaffected until late in the disease. In most cases sensation remains intact. Mental debility is not infrequently present. Vertigo is not uncommon; there may be sudden attacks of coma, as in general paresis. Remissions occur, sometimes at intervals of many years, in which all the symptoms may greatly improve. In all cases in which paresis of one or of several

extremities disappears only to reappear much later on, insular sclerosis must be suspected (Buzzard).

Diagnosis.—The symptom-complex of volitional tremor, scanning speech, nystagmus, and more or less spastic weakness of the legs usually renders diagnosis easy in typical cases. In its early stage it resembles very closely hysteria; the nystagmus, the vesical disturbances, and the volitional tremor will be useful in differentiating them. The tremor in hysteria is not volitional. Paralysis agitans and certain cases of general paresis simulate this disease so closely that, near the end of the disease, differentiation may be impossible.

Westphal's *pseudosclérose en plaques* is still more difficult to differentiate.

Diffuse sclerosis of the brain is not a congenital affection, but it attacks previously-healthy individuals. It is quite distinct from multiple sclerosis. The differential diagnosis between diffuse cerebral sclerosis and cerebral tumors is very difficult on account of the extreme rarity of the affection. O. Heubner (*Charité Annalen*, xxii, p. 293, '97).

Disturbance of vision is the initial symptom of multiple sclerosis, and is by no means rare. Frequently it is difficult to elicit the symptoms, however, for the patients have forgotten it. It is particularly important, because in many cases it renders possible the differential diagnosis between multiple sclerosis and syphilis of the brain. Frank (*Deut. Zeit. f. Nervenk.*, Dec. 22, '98).

Etiology.—The etiology of this disease is obscure. Scarlet fever and other infectious diseases have been referred to in this connection. Although not infrequently occurring in children, it is most common in young adults. Trauma, congenital predisposition, and metallic poisons have been mentioned as etiological factors.

Two cases, due to influenza, in which sclerous encephalitis was consecutive to

an infectious circumscribed arteritis. H. Rendu (*Comptes Rendus Heb. des séances de l'Acad. des Sci.*, Paris, Dec. 21, '94).

Pathology.—The grayish-red areas are scattered indifferently through the white and gray matters (E. W. Taylor). The sclerosed patches are most abundant in the neighborhood of the ventricles, and in the pons, cerebellum, basal ganglia, and the medulla; histologically in the sclerosed patches there is marked proliferation of the neuroglia, the fibres of which are denser and firmer; the gradual growth destroys the medulla of the nerves, but the axis-cylinders persist in a remarkable way (Osler). Redlich, of Vienna, finds several processes: either there is a pronounced thickening of the neuroglial tissue, containing the remains of the nerve-fibres, above all, of bare axis-cylinders, or it will be found that, with a relatively slight alteration in the neuroglial tissues, the nerve-fibres are missing, in which case a fine, thin network has replaced them. Redlich does not believe it proved that the process originates as an inflammatory one in the vessels, or that the neuroglial proliferation is the primary factor, but rather inclines with O. Huber to the opinion that the process is one of degeneration affecting particularly the nerve-fibres. He explains the presence of the volitional tremor as a functional weakness of the nerve-apparatus, as there is no anatomical localization for this symptom. He classes nystagmus with the volitional tremor as having no anatomical localization. Scanning speech is most likely referred to the sclerotic areas in the pons and in the medulla oblongata (its favorite location); speech must naturally be first to suffer from areas of sclerosis in the bulb, since it requires the finest innervation, being the most complicated of the physiological processes.

Prognosis.—The prognosis is unfavorable. The patient becomes bedridden unless he dies in the meanwhile of some acute disease.

Treatment.—No known treatment has any influence on the progress of sclerosis of the brain, but a prolonged course of nitrate of silver may be tried, and arsenic is recommended (Osler).

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SCORBUTUS (SCURVY).

Definition.—A general disease characterized by marked adynamia, spongy gums, and a tendency to hæmorrhage, due to deficient or improper food.

Symptoms.—The first sign of the disease is fatigue and general depression, accompanied sometimes by muscular pains in the back and calves. Pallor, loss of flesh, and anorexia follow, and the typical sign of the disease then appears: swollen and spongy gums that bleed upon slight contact or pressure. The gingival mucous membrane becomes bluish and is more or less ulcerated, the ulcers sometimes reaching the deeper tissues and causing necrosis of the alveolar process. The breath, owing to the presence of necrotic tissues, becomes exceedingly foul. The teeth, at first loosened, may fall out. The tongue is swelled and red; this with enlargement of the maxillary, sometimes adds much to the patient's discomfort. The temperature is often subnormal.

Hæmorrhagic spots of various forms and size appear over the surface. In some cases they resemble ecchymoses; in others, purpura, petechiæ, pemphigus, lichen, and other cutaneous disorders, the skin in all being rough and dry. The hæmorrhages may be deep-seated, giving a bosselated appearance to the limb affected. Hæmorrhages from the

nose, stomach, bladder, and intestines may also occur, complicated, in some instances, by extravasations into the pleura, pericardium, meninges, and joints. The latter, especially the ankles and wrists, are sometimes œdematous. Necrosis of the bones, epiphyses, and of the callus, in recently-fractured bones, is observed. Cardiac disorders frequently appear. The pulse becomes weak, irregular, and rapid; the area of dullness is increased, and a hæmic murmur at the base is often distinguishable. The urine is usually albuminous and dark, the phosphates being increased. Its specific gravity is always high. Disturbances of vision are occasionally complained of. Attacks of syncope and delirium are common, convulsions are sometimes witnessed, while hemiplegia also occurs as a complication of the later stages. The mortality from this disease, which is infrequent nowadays, owing to protective legislation bearing upon the food-supplies of ships, is not great. Death usually occurs from heart-failure, hæmorrhage, etc., or as a direct result of some intercurrent disorder.

Etiology and Pathology.—Scurvy has become almost extinct, owing to the changes brought about in the food supplied to the crews of ships, in prisons, work-houses, barracks, etc. What the precise elements are is still a subject of controversy, but the best evidence tends to show that the disease is due to the insufficiency or absence of the potassium salts, the organic salts of fruit and vegetables, which, individually or collectively, maintain the alkalinity of the blood up to its proper standard, through the carbonates derived from them. These failing, acid intoxication results, affecting not only the tissues proper, but the blood also, especially in respect to its coagulability. The blood is rendered dark and

fluid, and resembles that of profound anæmia without leucocytosis. According to Wright (Army Med. Rep., '95), the presence or absence of acid intoxication may be ascertained by determining the total acid which is being excreted in the urine. In acid intoxication there is a notable increase of the ammonia-neutralized acid excreted as compared with the free acid. Contrary to general belief, it is not the citric acid of lime-juice which is beneficial in scurvy, citric acid having proved useless when administered alone; the antiscorbutic effects are due to the potash salts which lime-juice contains. The disease has been ascribed by others to a micro-organism or its toxins, but efforts to isolate a specific germ have so far remained fruitless.

Scurvy is a chronic ptomaine poisoning, the ptomaines being derived from badly preserved milk, tinned meat, or salt beef. If the provisions were well sterilized and no subsequent changes took place in the food, there would be no scurvy in the ship's crew, and it would be unnecessary to take preserved vegetables or lime-juice. Regular exercise, fresh air, and temperate habits also conduce to freedom from scurvy. Nansen (Northwestern Lancet, Nov. 1, '97).

In Russian epidemic in every instance the occurrence of scurvy was entirely due to lack of food, and, when the relief measures were put in force, scurvy disappeared. There was no evidence whatever that scurvy could become infectious. Children, it was observed, who were suckled by scorbutic mothers, in no instance developed the disease. Editorial (Vratch, No. 29, '99).

There is no condition of the blood characteristic of scurvy. Gingivitis is not a constant symptom. In certain cases there is a condition of the blood similar to that existing in pernicious anæmia, though any definite connection between the two diseases is not demonstrated.

The most important etiological element appears to be a diet lacking in

vegetables or their ingredients. Tainted food may produce it, and an exclusive diet of perfectly fresh meat and blood may prevent it. The infectious theory is gaining a strong foot-hold among the authorities, although no definite micro-organism has been recognized. J. E. Talley (Jour. Amer. Med. Assoc., Nov. 1, 1902).

The pathological features, beyond those described under SYMPTOMS, consist in parenchymatous changes in the viscera, notably the heart, liver, and kidneys.

Prophylaxis.—Scorbutus has almost totally disappeared, owing to the wise laws enacted by the various maritime countries, and the conversion into transportable articles of diet of fresh vegetables and fruits, which formerly were classed as perishable property. Ships and armies can now be fully supplied with these antiscorbutic articles in sealed cans and jars, and any number of men can be protected for any length of time.

Treatment.—If the prevailing view in respect to the pathogenesis of the affection is correct, there are three main indications: (1) to supply the scorbutic organism with fixed alkalies to replace those which have passed out in the urine with the excessive acid of the food, (2) to give remedies which at the same time shall relieve the defect of blood-coagulability, and (3) to combine these *desiderata* with portability and inexpensiveness in the drugs. Wright (*loc. cit.*) contends that lime-juice and fresh vegetables do not fulfill the latter condition, and that the use of non-poisonous organic acid salts of potash and soda are necessary. He recommends 30 to 60 grains of Rochelle salts by the mouth daily, and 20 grains of chloride of calcium three times a day to enhance the blood-coagulability.

Fresh fruit, especially lemons, oranges, vegetables, potatoes, cabbage, lettuce,

etc., freely eaten, soon bring on convalescence, however, especially when combined with eggs, meats, fowl, milk, and other foods calculated to increase the patient's vigor. Remedies should only be used to counteract constipation or to alleviate the oral lesions by local applications (see STOMATITIS) tending to correct the foetor and relieve the surfaces of *detritus* and discharges. Cleanliness of the mouth is important; this is best obtained by means of a solution of borax, 20 grains to the ounce.

SCORBUTUS, INFANTILE.

Definition.—A constitutional disease probably identical with scurvy of adult life, but occurring in children and usually in those under ten years of age.

Although the disease is often associated with rickets, there appears to be no necessary connection between them. Many cases have been described under the title of "Acute Rickets."

A disease observed in infants characterized by acute pains in the limbs, especially in the direction of the long bones; frequent gastric derangements; leaden hue of the surface, with occasional oedema of the extremities, and hæmorrhagic spots. De Mussy (La Méd. Mod., Dec. 10, '92).

Symptoms.—The disease generally shows itself by great tenderness in the lower extremities and unwillingness on the part of the child to move them or have them moved. Following this some swelling may be discovered in the shafts of the leg or sometimes about the knee or ankle, in one limb or both. Sometimes no swelling can be discovered. In other cases other parts of the body are affected. The back becomes weak; the joints themselves are uninvolved; anæmia, debility, and ecchymosis may appear. The gums become swelled,

spongy, and usually of a purplish blue, and often cover the teeth. Sometimes fractures of the bones take place. The eyes may become very prominent.

Infantile scorbutus occurs in every grade of life, but is more frequent among the rich than among the poor. It may appear at any period of infancy or early childhood, but is most common between the ninth and fourteenth months. The essential symptoms are divided into two groups. In the first, or primary, group are: pain on motion, painful swelling of the lower extremities, and spongy and bleeding gums. The secondary symptoms are: subcutaneous hæmorrhages, pseudoparalysis, and hæmorrhages from the cavities of the body. Pain on motion is a constant symptom; it develops early, and is frequently so intense as to cause the child to cry out at the slightest jar or motion. In the early stages it is frequently difficult to determine its exact seat. Painful swelling of the lower extremities is one of the most characteristic and constant symptoms; the upper extremities are rarely involved. The thigh is affected more frequently than any other region. The swelling is above and not at the knee-joint, as in rheumatism. The gums are purplish, soft, spongy, and bleeding, and frequently show decided ulcerations. When the teeth have not come through, changes in the gums are usually slight or entirely absent. Subcutaneous hæmorrhages as well as hæmorrhages from the cavities of the body are very common, but are not necessary to a diagnosis of scurvy. A varying degree of immobility of the extremities is also common, and the condition is frequently so marked as to simulate paralysis. Fever is often present, and is usually intermittent in character. Diarrhœa is more frequent than constipation. Crandall (*Archives of Ped.*, July, '97).

Diagnosis.—The diagnosis rests upon the extreme tenderness and pain on handling, the subperiosteal swelling, and the spongy gums. The disease is often at first confounded with rheumatism, from which it is to be distinguished by

the fact that there is no inflammation of the joints present. Rachitis, although sometimes combined with it, is to be distinguished from it by the presence of the rosary and often rickety symptoms, and by the absence of hæmorrhages and intense pain. This disease can scarcely offer any difficulty.

Besides pallor and anæmia there is a group of symptoms that is characteristic: 1. A fusiform or cylindrical swelling of one or both thighs, due to subperiosteal hæmorrhage about the shaft of the femur. This may involve the upper part of the leg also. 2. The gums will be found to be swelled, spongy, dark purple in color, bleeding freely on touch, or perhaps covered with dry blood. 3. A dark circle about the eye, as if a blow had left a "black and blue" mark. The tendency throughout the disease is to hæmorrhage. These symptoms should always enable one to distinguish the disease from rachitis. Other diseases which may be mistaken for scurvy are acute rheumatism, infantile paralysis, periostitis, abscess of hip or knee, and sarcoma. Other conditions to be remembered in making a differential diagnosis are hæmophilia, leukaemia, purpura hæmorrhagica, and erythema nodosum. W. F. Cheney. (*N. Y. Med. News*, Feb. 29, '96).

Infantile scurvy may be mistaken for rheumatism, stomatitis, rickets, sarcoma, osteitis, and infantile paralysis. The result of antiscorbutic treatment is one of the most certain means of diagnosis. Crandall (*Archives of Ped.*, July, '97).

There are two affections occurring in children for which scurvy is particularly mistaken: acute rheumatism and acute anterior poliomyelitis. There is no reason why scurvy should be confounded with the latter disease. There is, of course, absence of movement in the limbs in both cases, but in anterior poliomyelitis this is due to inability to move them because of palsy. In scurvy the failure of movement is due to pain. This can very easily be decided by passive movements. Scurvy and acute rheumatism are not so easy to differentiate. In scurvy, however, the hæmorrhage is not

into the joint and not into the epiphysis, but practically always into the diaphysis of the long bones. Blood-extravasations occur at times over the tissue and occasionally even over the carpus, but these are rare exceptions. If the bones are protected from motion it will be found that the joints in scurvy may be freely moved. At times in scurvy hæmorrhage occurs into the joints, and this may almost hopelessly confound the disease with rheumatism; but these joint hæmorrhages are very rare. Abram Jacobi (Med. News, Oct. 28, '99).

Attention called to the frequency with which scurvy in infancy is mistaken for acute articular rheumatism. A point of differential diagnosis is the rarity of articular rheumatism in the first five years of life. Infantile scorbutus usually appears in the children of the well-to-do, in distinction from rickets, which, on the other hand, seems to be the disease of the poor. H. A. Hare (Med. News, Feb. 16, 1901).

Etiology.—Of the many cases now recorded the majority have occurred in infants between the eighth and twentieth months. Race, sex, and season appear to excite no influence. Children of the better classes seem more prone to the disease. The use of food unsuited to the children seems to be the great cause; but just what the chief fault in the diet may be is not yet determined. Certainly the majority of cases seem to have developed in infants fed upon the proprietary foods.

Three hundred and seventy-nine cases of infantile scurvy investigated. The disease is most apt to develop between the ages of seven and fourteen months, inclusive, and has a greater tendency to occur among the rich or the well-to-do. The most important etiological factor is a dietetic one, 214 of the cases (60 per cent.) having been fed on proprietary foods. There does not seem to be evidence that the association of rickets and scurvy is at all intimate. Very possibly the same defect in diet which produces

the one produces the other also, but the rapid recovery under treatment which the scurvy underwent did not apply to the rickets. This seems to indicate only accidental association of the two diseases; certainly not any causal relation between them. Committee Amer. Ped. Soc. (Med. Rec., July 2, '98).

Two cases of infantile scurvy due to a prolonged diet of sterilized milk and cream, and two due to patent foods. The boiling of milk for infants is essential, except under certain circumstances, and the longer milk is boiled and the higher the temperature to which it is subjected, the less will be its antiscorbutic value and nutritive principles. E. Cautley (Lancet, July 20, 1901).

Sixteen cases of infantile scurvy under the writer's care during the last eighteen months. A study of these cases supports the generally accepted view that the patented foods often produce infantile scurvy, and some of them show that recovery may follow the withdrawal of these foods without other treatment. The cause of this action is in doubt. It may be that they are so commonly derived from or contain starch, or that they are deficient in certain ingredients. Two of the cases throw suspicion on barley-water. These cases indicate also that the sterilization of milk has an undoubted power to produce scurvy, but it is a less prominent factor than the patented foods. It is seen that scurvy can readily develop on a diet of milk which is not long heated or which is even raw. In some of the cases fruit-juice was given, and improvement noted, without any change in the food whatever. Whereas there are classes of foods which are particularly apt to produce scurvy in infants, yet the individual element is remarkably present in this disease. J. P. Crozer Griffith (New York Med. Jour., Feb. 23, 1901).

The direct causal factor of scurvy in infants is the continued use of food that lacks some essential nutritive elements or presents them in a form not readily assimilable. To put the whole question in a few words, the cause of scurvy in infants is *continued deprivation of fresh food*.

The faulty foods may be classed in the order of their potency:—

1. The different proprietary infants' foods administered without the addition of cows' milk. These foods are responsible for the greatest number of cases, and which variety most readily induces the disease depends chiefly upon the extent of employment or the fashion at the time.
2. Proprietary foods employed with the addition of insufficient quantities of cows' milk.
3. Oatmeal- or wheat- gruel. Barley and other farinaceæ administered with water alone or with water and insufficient cows' milk.
4. Condensed milk and water.
5. Sterilized milk. Properly modified milk mixtures subjected to a temperature of 212° F. (100° C.) from thirty minutes to an hour or more.
6. Too dilute milk and cream mixtures. Laboratory mixtures with too low albuminoid percentage.

Consideration of these groups furnishes an explanation of the greater frequency of scurvy in infants reared in luxury than in the very poor. Louis Starr (Phila. Med. Jour., April 27, 1901).

Observations upon one hundred and seventy-nine consecutive cases which have been fed during a period of from three to eighteen months, pasteurized milk being given for nine months of the year, while during the three summer months sterilized milk was used. The milk has been given out by competent nurses. Careful examination of the children so fed have shown that 97 per cent. of the cases presented unmistakable signs of rickets or scurvy, most of the cases being rickets or a combination of rickets and scurvy. About 40 of the children had from five to seven daily feedings of the sterilized milk, supplemented by breast-feedings. These all showed signs and symptoms of rickets, although not so marked as in those who were fed upon this modified milk exclusively. The changes most frequently seen were beading of the ribs, pot-belly, sweating, flabby muscles, cranio-tabes, and restlessness at night. These results would seem to add valuable evidence in support of the claim which has been urged so generally by competent authorities that the best substitute for mothers'

milk is fresh, pure, raw cows' milk. E. M. Sill (Medical Record, Dec. 27, 1902).

Pathology.—The most characteristic change consists of subperiosteal hæmorrhages, which produce the swelling. Hæmorrhage into the muscles is sometimes seen and hæmorrhage under the mucous membranes is common. The marrow is hyperæmic and rich in lymph-cells and leucocytes. (Lunz.)

Prognosis.—The disease tends to run a chronic course except when treated appropriately. Then the recovery is sometimes phenomenally rapid. If recognized and treated, or if severe complications are present, death is not rare.

Treatment.—This consists in correcting the diet and in giving fresh fruit-juices, especially orange-juice. All proprietary food should be abandoned. Sometimes a change from cooked to raw milk seems to be advantageous. Tonics may be needed later, but are of no service for the direct treatment of the scurvy.

Three measures are indicated for the cure of scurvy: Discontinue the proprietary food. Substitute for it a mixture of fresh milk diluted with water or with oatmeal water. Give fresh orange juice, in dose of one or two teaspoonfuls three times a day. It is surprising how babies with scurvy take to this and seem to enjoy it. Give freshly expressed beef-juice, squeezed from rare steak, in doses of one or two teaspoonfuls three times a day. Give no drugs at all. All of the author's cases have been treated in this simple way. In one case every symptom had vanished in four days after treatment as above. In another case, after ten weeks of suffering, the baby was absolutely well in one week. Cheney (Medical News, June 4, 1904).

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SEBORRHŒA (STEARRHŒA).

Definition.—A disease of the sebaceous glands, due to one or more micro-organisms, characterized by an increase in the amount and alteration in the character of the glandular secretion and the formation on the scalp and other cutaneous surfaces of an oily coating and fatty scales.

Varieties and Symptoms.—There are three main forms of seborrhœa:—

SEBORRHŒA CAPITIS, often termed pityriasis, an advanced form of what is popularly known as “dandruff.” It is characterized by a desquamation of the scalp, and occasionally of neighboring hair-covered regions: the eyebrows, beard, etc. The scales are grayish white, thin, and fine, and fall in such quantities at times as to resemble a thick coating of dust on the patient’s clothing, especially the collar and shoulders. Slight itching is sometimes complained of, and falling of hair may occur. It is a stubborn affection, which simulates eczema in some cases.

SEBORRHŒA SICCA.—This is a milder form of dandruff very commonly observed. Besides its area of predilection, the scalp, seborrhœa is often occasionally found in various regions, the face of children and young women, the beard, the back between the shoulder-blades, etc. The yellowish-white scales formed accumulate over the affected region, and the uppermost scales fall off as a scurf as soon as they become dry, in the form of fine, pellucid, glistening scales. Hairs are often lost, especially at the vertex, constituting alopecia furfuracea.

SEBORRHŒA OLEOSA is generally limited to the face and is due to hypersecretion from the sebaceous glands. As a result, the skin is covered with an oily coating, which gives the region a shiny appearance. Upon the application over the affected area of a piece of absorbent

paper, a large number of fine grease-spots will appear, corresponding to the glandular orifices. Dust may accumulate in the latter, constituting the so-called seborrhœa nigricans. The skin may preserve its usual color or appear congested and thickened. Seborrhœa oleosa is often observed in drunkards, and may occur as a complication of acne rosacea. (See also ECZEMA, volume ii.)

Etiology and Pathology.—Sabouraud has recently expressed the view that the causal organism of alopecia areata was also that of seborrhœa. He holds that when the microbe becomes implanted in the pilo-sebaceous follicle it sets up an epithelial overgrowth which encysts groups of the organism; these are ultimately expelled as plugs. Four successive stages may then result: a sebaceous hypersecretion of oily fluid, a gradual enlargement of the sebaceous gland, a progressive atrophy of the infected follicle, and finally death of the hair. These stages correspond to the various forms of seborrhœa, to which pityriasis is often added through secondary infection. Brocq favors a plurality of pathogenic organisms, probably saprophytes, especially in the cases complicated with eczema, which organisms are capable of becoming pathogenic under certain conditions and in appropriate soil.

What used to be known as pityriasis simplex capitis is a thoroughly differentiated chronic epidemic mycosis, usually of the scalp. It may become infected and take on new characteristics, becoming seborrhœic. In hairy regions, pityriasis paves the way for seborrhœa; after years of simple pityriasis, seborrhœa of the scalp supervenes, producing ordinary masculine baldness. In regions devoid of hair, seborrhœa precedes pityriasis. Sabouraud (*Presse Méd.*, June 4, 1904).

Treatment.—In many of these cases, if not in all, there is an underlying dys-

crasia which must be met by appropriate measures. The gouty and rheumatic diatheses prevail in many; neuroses are often traceable in the individual or personal history; a lymphatic temperament is usually observed in children; anæmia is a frequent accompaniment of the disease in young women. The salicylates are of value in the first; strychnine and arsenic in the second; the iodides and iron in the third, and iron and arsenic in the fourth class of cases. A carefully regulated, but nutritious, diet is necessary, the avoidance of much meat being indicated in gouty individuals.

In dry seborrhœa Brocq recommends the following:—

℞ Betanaphthol, 4 $\frac{1}{2}$ grains.
Camphor,
Resorcin, of each, 3 grains.
Precip. sulphur, 45 grains.
Vaselin, 5 drachms.—M.

This ointment is applied carefully to the scalp by parting the hair in many places, removing any excess with a soft handkerchief. Next morning the head is cleansed with a little ether. In oily seborrhœa Brocq applies the following lotion, three times a week, in the same manner as the naphthol mixture:—

℞ Sulphur, 6 $\frac{1}{2}$ drachms.
Camphorated alcohol, 1 $\frac{1}{2}$ ounces.
Glycerin, 1 $\frac{1}{4}$ ounces.
Distilled water, 6 $\frac{1}{2}$ ounces.—M.

Lassar, in cases in which sulphur cannot be conveniently used, applies the following salve three times a week, or less often if it proves irritating:—

℞ Pilocarpine, 30 grains.
Vaselin, 20 grains.
Lanolin, 80 grains.
Essence of lavender, 25 drops.—M.

To cleanse the scalp a solution of bicarbonate of sodium, 5 drachms to the

quart of water, may be employed. A borate-of-sodium solution, 1 $\frac{1}{4}$ drachms to the pint, is more effective when the scalp is very oily. This solution should be used once a week and the following wash used daily with a soft tooth-brush, parting the hair in many places:—

℞ Tannin, 15 grains.
Alum, 1 drachm.
Rose-water, 6 ounces.—M.

Skinner recommends the following lotion, which serves as a tonic to the scalp and tends to encourage the growth of hair:—

℞ Tinct. of cantharides, 14 drachms.
Tinct. of cinchona, 2 ounces.
Tinct. of benzoin, 6 drachms.
Spirit of lavender, 1 $\frac{1}{2}$ ounces.
Castor-oil, 2 drachms.
Alcohol, enough to make 10 ounces.—M.

The castor-oil should be dissolved in the alcohol, then mixed with the tinctures and spirit, and filtered through kaolin.

When there are incrustations, which are often observed in children and aged people, the crusts should be poulticed off and their bases anointed with the following salve:—

℞ Ichthyol, 45 grains.
Lanolin,
Vaselin, of each, $\frac{1}{2}$ ounce.—M.

The methods hitherto employed for the removal of the crusts of seborrhœa sicca have been either alkalies, by which the crust is more or less saponified, or, more usually, oils of one sort or another whereby they are liquefied. Neither of these methods is very satisfactory. As the crust is composed chiefly of fat, it was thought that a solvent might act better, and benzene suggested itself. The first patient it was tried on was a young man aged 25. He was getting very bald and had a thick crust of

seborrhœa sicca. It was applied with a shaying-brush, and the whole thing disappeared in about two minutes. The benzene leaves the hair and scalp very dry, and inunctions must follow. For this bay-rum and castor-oil, of each, fʒiiss; tr. canth., fʒij; aq. colonizæ, fʒss; may be used every morning, and the benzene be repeated about once in five days. For mild cases of the seborrhœa-oleosa type, the benzene may be combined with an equal quantity of rectified spirits. No hairs are broken off in the removal of the crust. A considerable number of cases have been successfully treated in this way. R. W. Leftwich (Brit. Med. Jour., Jan. 5, 1901).

SEPTICÆMIA AND PYÆMIA. See WOUNDS (SEPTIC) AND GANGRENE.

SHOCK.

Definition.—A general depression of the vital functions due to lowered blood-pressure, brought on by vasomotor paresis of central origin, and occurring either as the result of considerable loss of blood, the accumulation of blood in the larger abdominal venous trunks, or contusion of the sensory nerves.

Symptoms.—Shock may present itself in forms varying in intensity from slight depression to profound collapse approximating death. The surface is pale or livid and cool; the eyes are staring or half-closed; the respiration is shallow and irregular; the pulse weak and rapid or imperceptible. These symptoms in severe cases are accompanied by loss of consciousness. The weakness of the muscles is a striking feature, those of the surface being flabby and impotent; the sphincters also fail to functionate from this cause, and involuntary evacuations result. Hiccough and vomiting are also frequent manifestations. The mind is dull and apathetic. Hypothermia, though seldom reaching to 3° F., is usual. The mental torpor gradually deepens, syncope

comes on, and death follows. This course depicts that observed in great injury involving considerable loss of blood, complicated probably with abdominal or cerebral lesions. Neurotic individuals and drunkards are also exposed to this rapidly fatal form.

In some cases the picture is quite different. Maniacal *furor* seems suddenly to develop, and the patient throws himself or his limbs in every direction, rolls his eyes, strikes right and left, and cries out at the top of his voice. Usually exhaustion soon comes on through recurrence, probably, of hæmorrhage on account of the violent exertion, and the patient lapses into the form previously described.

In cases that proceed favorably, the change for the better is termed the "reaction." All the abnormal symptoms disappear gradually, the return of the muscular tone being manifested by turning, shifting position, etc., while the cardiac symptoms lessen in intensity as the facial color returns. Some cases at this stage go through the maniacal type of shock through unduly rapid resumption of cerebral blood-pressure. In some cases it becomes a sign of septic infection. The temperature in a favorable case remains near the normal, though it may exceed this to a marked degree in children without indicating that a complication has occurred. This reaction fever sometimes lasts a couple of days, then gradually disappears.

Etiology and Pathology.—The prevailing view is that shock is mainly due to reflex paresis of the vasomotor centres, as a result of violent commotion or contusion of sensory nerves. Mechanical injury of the abdominal organs is also capable of inducing this central disturbance. Goltz's well-known experiments in this direction were recently repeated by Parascandola (Archives de Pathologie, p. 138,

'98), who utilized guinea-pigs instead of frogs. He stretched the animals out flat by their feet and gave them a sharp blow upon the abdomen with a flat ruler. The animals reacted in various ways to the traumatism; the greater number of them, after a period of temporary quiet, became apparently well; but in from thirty-six to forty-eight hours they died with the symptoms of exhaustion or shock. The cerebrum, cerebellum, medulla, and cord were removed and preserved in appropriate fixatives, and studied by the Golgi, Marchi, and Nissl methods. The alterations found by the Golgi method consisted in a deformity of the cell-body advancing to the grade of actual atrophy, node-like swellings on the dendrites, and fragmentation of the same. By the Marchi methods he noted simple marginal degeneration of Lissauer's zone and of the posterior roots proceeding to degeneration of the posterior columns; in some instances Gowers's tract, the crossed pyramidals, and the direct cerebellar tracts were involved, and sometimes there was a total degeneration of the entire cord. As observed by the methods of Nissl, the cytological alterations were various, but pronounced. Chromatolysis was present in a large number of cells. In those affected in a mild degree only, the chromatolysis was more peripheral than central; in the severer grades the chromatolysis was complete. In a large number of the cells peculiar abnormalities in the distribution of the chromophilic granules were noted; there were peculiar perinuclear bonnet-shaped masses, or fusiform, or like a crown about a rarefied perinuclear space. Further changes in the protoplasm were noted, rarefaction going on to vacuolization and to total disappearance of the cytoplasm. Changes in the achromatic reticulum were noted by the

author, consisting in a widening of the mesh and a contraction of the protoplasm within the mesh, resembling an atrophy. Changes in the nucleus were also observed. At times there was an unimportant dislocation, but the gravest changes consisted in a vesicular swelling of the nuclear protoplasm, which varied to a notable degree—at times very slight, at times marked. In some sections there were pronounced abnormalities in the coloration of the nucleus.

As a result of the central disorder, the vasomotor system becomes more or less incompetent, and reduction of the blood-pressure follows; the peripheral and cerebral vessels are depleted, while the larger trunks within the abdominal cavity are engorged. This explains the greater danger of a fatal issue when much blood has been lost, the medullar and spinal changes being thus accentuated.

Shock in obstetrical surgery is most apt to occur in fat, neurotic women living in comfortable circumstances, and sometimes accustomed to luxury. Old primiparæ are especially exposed to this danger. Coe (*Amer. Gynec. and Obstet. Jour.*, Apr., '97).

Shock is not due to a paresis of the circulation, especially of the heart and arteries, but to a profound disturbance of the entire vasomotor and sympathetic systems. This disturbing influence may reach the vasomotor centre through various channels, as, for instance, by direct irritation of the sympathetic nerves in abdominal operations; by crushing injury to the skeletal nerves, as in railroad injuries; and through the medium of the brain, as in sudden fright. Or two or more of these factors may unite as a causative influence, as in railroad injury, where the influence of sudden and great fright is added to the crushing of the large nerve-trunks. The condition induced is essentially an excessive vasoconstriction. Saline solution thrown into the veins recommended. The latter should be given at a temperature of 115° or 118°

F. (45.9° or 47.5° C.). Thus administered, the heat of the solution is brought directly to the irritated ganglia, and vascular spasm is relieved. Eugene Boise (New York Med. Jour., April 12, 1902).

Shock must not be considered as due to the lowering or exhaustion of one bodily function, but as a composite condition embracing an interference with the normal height of the blood-pressure with the respiratory act and with a marked fall in the body temperature. That there is a relationship between the fall in body temperature and shock is evident by considering (*a*) that in one series, the fall in temperature was the sole cause of shock; (*b*) that by continuous bath the temperature fell but one degree. The respirations increased, instead of diminishing, and the fall in blood-pressure was greatly lessened; (*c*) that by raising the body temperature previously lowered in shock, the respiratory rate was increased and the blood-pressure raised. Of the three factors concerned, the temperature commands the first place by its powers of production, limitation, and amelioration of a composite condition—shock. G. C. Kinnaman (Annals of Surgery, Dec. 1903).

Prophylaxis.—The prevention of shock during and after operations has received of late years considerable attention. Senn prepares his patients for grave operations by administering 2 ounces of whisky by the stomach or per rectum an hour before the time set for the operation and by injecting $\frac{1}{30}$ grain of strychnine hypodermically a few minutes before anæsthetizing the patient. These prophylactic measures have been found of great value in minimizing the danger from anæsthetics and the shock incident to the operation. He likewise deems it important to prevent a loss of heat, and to favor peripheral circulation by enveloping the body and limbs during the operation.

In order that patients should be in the best possible condition for operation, they should be prepared by moderate and judicious stimulation. Commencing six hours before the operation they receive from 1 to 3 teaspoonfuls of whisky in 1 ounce of hot water every hour until the time for operation. Two hours before operation 1 or 2 ounces in 4 ounces of warm normal saline solution are passed into the rectum, high above the brim. Intravenous injections of the normal saline solution at a temperature of 115° F., from 1 pint to 3 quarts, as may seem to be demanded by the effect produced, should be used if the patient has lost much blood. The pulse should be watched during the transfusion, and when the desired tension is restored the injection can be stopped. The same can be repeated again in four to twelve hours if occasion demands. Horace T. Hanks (Amer. Gynæc. and Obstet. Jour., Sept., '98).

Treatment.—Absolute rest and quiet in the recumbent position, the external application of heat (taking care that the water-bottles or bags used be not too hot, lest they burn the patient) around the trunk and extremities, are the first measures to be resorted to. Senn recommends the inhalation of nitrite of amyl, and the administration of stimulants, such as alcohol, camphor, coffee, and tea. Of alcoholic stimulants, hot red wine, rum, and brandy-punch deserve the preference. If spirits are used, an ounce should be given every fifteen to thirty minutes until reaction is established. Copious rectal enemata of hot normal salt solution are always valuable in the treatment of pronounced shock. Subcutaneous or intravenous infusion of the same solution is also of value. Opium is contra-indicated in the treatment of uncomplicated shock. Subcutaneous injections of sterilized camphorated oil is deemed by Senn a valuable cardiac stimulant, 3 or 4 hypodermic syringe-fuls being administered every fifteen minutes until reaction

sets in. Electrical stimulation of the phrenic nerves and artificial respiration are indicated. In shock the absorption of all drugs administered by the stomach or rectum, or even injected into the tissues, is always slow; hence, care is necessary to guard against an accumulative action during the recovery of the patient.

A valuable solution for intravenous infusions in shock is that recommended by Ringer, as follows:—

R. Calcium chloride, 1½ grains.
Potassium chloride, 1 grain.
Sodium chloride, 90 grains.
Water, 1 quart.—M.

Careful asepsis of the arm, apparatus, and solution is insisted upon; also the exclusion of all air from the tube before introducing the cannula. The solution should be free from solid particles. A probe-pointed cannula should always be used. If these points are carefully observed, there is little danger in the proceeding.

The temperature of the solution should be about 100° F.; hotter solutions are of greater value as a stimulant; an initial temperature of 108° to 110° F. is well borne. The fluid is cooled from one to two degrees by entering the cannula. The amount of the solution to be injected at one time varies with the rapidity of the injection and with the quality and tension of the pulse; 1 quart, repeated when necessary, is generally better than a large amount given at one time. The infusions are of most value in shock accompanied by hæmorrhage; the nearer the symptoms approach those of pure shock, other things being equal, the less effective is the infusion. D. F. Jones (Boston Med. and Surg. Jour., Feb. 1, '99).

Among the preventive measures of shock greatest reliance can be placed upon free use of intravenous, hot, saline infusion, injected while the patient is still upon the operating-table. Whenever possible, the solution should be introduced into the median basilic vein, but occasionally a vein in the operating wound will answer the purpose, or, if necessary, the solution may be intro-

duced into the common femoral artery with the aid of an hypodermic needle attached to a fountain-syringe. Next in order of efficiency to intravenous saline infusions are those introduced into the rectum. Hypodermoclysis is the slowest of all the methods; a heaping teaspoonful of common salt to the litre or quart; plain warm water, devoid of sodium chloride should never be used intravascularly, as it may prove fatal by producing a rapid disintegration of the red disks. The proper temperature for the solution is about 150° F. At least 1 litre, and sometimes even 2 or 3 litres, may be injected, providing the precaution is taken to introduce the solution slowly. The time occupied in introducing the fluid should never be less than ten minutes per litre. The employment of intravenous injections before or at the beginning of the operation is not considered good practice, since, by increasing the blood-pressure, it encourages freer hæmorrhage. Robert H. M. Dawbarn (Boston Med. and Surg. Jour., Feb. 22, '99).

Patients are personally prepared for grave operations by administering 2 ounces of whisky by the stomach or rectum an hour before the time of operating, and by injecting 1/30 grain of strychnine hypodermically a few minutes before anæsthetizing the patient. These measures are of great value in lessening the danger from anæsthetics and the shock of the operation. It is also important to prevent loss of heat and favor peripheral circulation by enveloping the body and limbs during the operation. In the treatment of traumatic shock, copious enemas of hot, normal salt solution should never be neglected. In the treatment of pronounced cases subcutaneous or intravenous infusion of the same solution is followed by most encouraging results. The absorption of all drugs is always slow; hence it is necessary to guard against cumulative action. The therapeutic value of strychnine in the treatment of shock is doubtful. Contejeans explains this by the fact that in animals in the state of shock the spinal cord is anæmic and not supplied by sufficient blood to convey the remedy to this

centre of innervation. N. Senn (St. Louis Courier of Med., July, '99).

In combating shock rapid hypodermoclysis may easily be practiced by means of four hypodermic needles adjusted to the ends of rubber tubes, which tubes unite and lead to a reservoir containing the salt solution. The needles are inserted under the skin at various points, the liquid being conducted by the pressure obtained by raising or lowering the receptacle. An apparatus with four needles is usually capable of introducing three quarts of solution into the tissues in half an hour. E. O'N. Kane (Jour. Amer. Med. Assoc., Mar. 3, 1900).

Adrenalin will raise the blood-pressure in normal animals in every degree of shock, with the medulla cocainized or in the decapitated animal. It is rapidly oxidized by the solid tissue and by the blood. Its effect is fleeting; it must therefore be given continuously. By this means the circulation of a decapitated animal was maintained ten and a half hours. G. W. Crile (Medical News, Nov. 29, 1902).

Adrenalin found to be more efficient in raising vascular pressure than either strychnine, digitalin, or normal saline solution; hence it was much better than these so-called stimulants, especially in cases in which the respiratory centres were not paralyzed. Adrenalin is indicated in vasomotor collapse following cocaine or chloroform poisoning, and shock after operation. When used, it should be given subcutaneously, and the site of the injection should be slowly and deeply massaged until the adrenalin shows its characteristic effect on the pulse. Too great dilution is not advisable, as absorption is slower and the effect is less energetic. M. S. Miles and W. Muhlbert (Cleveland Med. Jour., Dec., 1902).

In cases of urgency adrenalin chloride should be given intravenously in a dilution of $\frac{1}{10000}$. The injection should be slow, thus prolonging the effect of the drug, and should be pushed up to 100 cc. of the strong solution or until the heart clearly and unmistakably responds to its influence.

There is as yet no convincing clinical

proof to the effect that the drug is as efficacious when used on men as laboratory experiments would lead us to suppose. Edward Martin and M. E. Pennington (American Medicine, Nov. 21, 1903).

The writer has used adrenalin chloride in a number of cases with positive results, employing the 1 to 1000 solution in doses of 4 to 8 drops hypodermically. The physiological action, as well as the clinical experiences that has been obtained from its use, would seem to indicate, he states, that it is a remedy of great value in vasomotor paresis or irritation of the sympathetic nerve centres. It has served him so well in five cases that he now always carries it in his emergency case and uses it almost daily in any condition of great cardiac depression as well as shock. F. H. McNaught (International Journal of Surgery, June, 1903).

SILVER. — Silver (argentum) in its pure metallic state has a perfectly white color and a high degree of lustre. It is unaffected by oxygen or moisture, but is readily attacked by sulphur, and tarnishes when exposed to the air containing hydrogen sulphide. The metal is not official, though some of its salts and the oxide are. Of official preparations of silver, the nitrate is most largely used.

Cyanide of silver (argenti cyanidum, U. S. P.) occurs as a white, odorless, and tasteless powder, which turns dark upon exposure to the light. It is soluble in potassium cyanide, ammonia, boiling dilute nitric acid, and in sodium thiosulphate. It is used for making the official dilute hydrocyanic acid, and is rarely used internally.

Iodide of silver (argenti iodidum, U. S. P.) occurs as a light-yellow, odorless, and tasteless powder, which is unaffected by the light, if pure. It is soluble in a solution of potassium iodide or cyanide, and in ammonium thiosulphate.

Nitrate of silver (*argenti nitras*, U. S. P.) occurs in colorless and odorless rhombic plates, having a bitter, caustic, metallic taste, and is rapidly reduced by organic matter when exposed to the light. It is soluble in 0.6 part of cold and 0.1 part of boiling water, in 26 parts of cold and 5 parts of boiling alcohol. It is incompatible with organic matter, hydrochloric acid, chlorides, phosphates, arsenites, opium, extracts, resin, essential oils, tannin, etc. It should be carefully preserved from light and air. The crystals are alone suited for internal use. For external use two preparations of the nitrate are official: the fused and the diluted nitrate.

Fused nitrate of silver (molded silver nitrate; lunar caustic; *argenti nitras fusus*, U. S. P.) is prepared by melting crystals of silver nitrate with 4 per cent. of official hydrochloric acid and running the resultant liquid into suitable molds. It occurs in white, hard, odorless, solid pencils or cones, having a fibrous fracture, and a bitter, metallic, caustic taste. It becomes gray or grayish black upon exposure, and is soluble in water, alcohol, nitric acid, etc.

Diluted nitrate of silver (mitigated stick; mitigated lunar caustic; *argenti nitras dilutus*, U. S. P.) is prepared by melting 1 part of silver-nitrate crystals and 2 parts of potassium nitrate. It occurs in white sticks and cones, is soluble in water, and is intended for external use where pure lunar caustic is too powerful.

Oxide of silver (*argenti oxidum*, U. S. P.) occurs as a heavy, odorless, brownish-black powder, having a disagreeable, metallic taste. It is incompatible with ammonia-water, creasote, tannin, acids, etc. It should not be triturated with oxidizable matter, as it may cause explosion. It is best dispensed mixed with some chalk and put in capsules.

Preparations and Doses.—*Argenti cyanidum* (U. S. P.), $\frac{1}{60}$ to $\frac{1}{20}$ grain.

Argenti iodidum (U. S. P.), $\frac{1}{2}$ to 2 grains.

Argenti nitras (U. S. P.), $\frac{1}{8}$ to $\frac{1}{2}$ grain.

Argenti nitras dilutus, U. S. P. (mitigated caustic).

Argenti nitras fusus, U. S. P. (lunar caustic).

Argenti oxidum (U. S. P.), $\frac{1}{2}$ to 2 grains.

Physiological Action.—Nitrate of silver coagulates albumin, and, when applied in its pure state to living tissues, coats them over with a tough, white film (albuminate of silver) and acts as a caustic. This caustic action is not, however, a deep one, because the tough film which is formed acts as a protective. In dilute solution its action is astringent, overcoming relaxation and constricting the vessels, and apparently alterative, improving local nutrition.

Taken internally in medicinal doses, silver nitrate acts as a tonic to the nervous system, causes changes in the blood, stimulates the heart, and promotes constructive tissue-metamorphosis and increases the secretion of the bile. Large doses, by reason of its caustic action, produce violent gastro-enteritis, thrombosis of the gastric veins, and ulceration of the mucous membrane of the stomach. On account of its affinity for organic matter, silver nitrate cannot long maintain its identity in the stomach. Bogolowsky (*Virchow's Archiv*, xlv, 413) has observed that, when silver nitrate is added to a peptone, it is readily dissolved, and that the solution formed does not coagulate albumin; that in this or in some analogous form silver is absorbed is proved by its having been found in various internal organs and by the discoloration which follows its protracted use.

The elimination of silver from the body is accomplished very slowly. Heller and Orfila failed to detect silver in the urine of animals taking it; others, however, have detected it in the urine, and it is probable that it is eliminated, though very slowly and in small quantities, by the kidneys. Frascchetti denies that it is eliminated by either the kidneys or the intestines. When silver is taken for a long, continuous period certain changes take place in the skin and mucous membrane which will be considered under **CHRONIC POISONING BY SILVER NITRATE**.

Poisoning by Silver Nitrate.—There are two forms of poisoning: that following a large single dose (acute) and that following the long-continued use of small doses (chronic).

ACUTE POISONING.—The symptoms of acute poisoning by silver nitrate are partly gastro-intestinal and partly cerebro-spinal. Either series of phenomena may predominate in a case of acute poisoning.

Almost immediately after a poisonous dose of the drug is taken, violent abdominal pain, with vomiting and purging, comes on. At the same time evidences of wide-spread gastro-enteritis develop. The abdominal walls become hard and knotted, more rarely scaphoid. The face becomes flushed or livid, and is covered with sweat. The expression is one of anxiety. When vomiting occurs, the ejecta are brown or blackish in color, sometimes white and curdy, especially after sodium chloride has been given. The lips, skin, and mouth are stained white, but rapidly change in color to brown and then black.

In some cases the nervous symptoms are severe: loss of power of co-ordination, paralysis, and convulsions with coma or delirium may occur. The con-

vulsions are severe, generally tetanic (H. C. Wood), and, according to Rouget, are plainly reflex and persist after the complete abolition of voluntary movements. Curci (London Med. Record, p. 72, '77) affirms that they are due to excitation of the motor tract of the cord, and that this is preceded by a similar influence upon the sensory tracts.

Death ensues from asphyxia due to centric respiratory paralysis (Rouget), accompanied by a profuse exudation of liquid mucus into the bronchial tubes, pulmonary congestion and œdema being found on post-mortem examination. Another theory is that the asphyxia accompanied by the excessive secretion and pulmonary congestion is caused by an altered state of the blood induced by the poisonous action of the drug (Krahmer, Rabuteau, Mourier).

In a case reported by Beck (Beck's Med. Jurisprudence, i, 675, Phila., '63) the symptoms were insensibility, violent convulsions, and dilated pupils, with, on a partial return to consciousness, intense gastric pain; complete restoration of consciousness did not return until eleven hours after administration, and the coma returned at intervals during several days.

At post-mortem the stomach and bowels are found corroded, often ecchymosed, and with patches of a white or grayish color. The lungs are congested and the bronchial tubes filled with fluid mucus. Poisoning by this drug is not common. H. C. Wood recalls (1894) but 3 fatal cases. The lethal dose is not certain; 30 grains have killed and recovery has followed the ingestion of an ounce.

Treatment of Acute Poisoning.—The chemical antidote is common salt (sodium chloride), which should be administered in large amounts. Vomiting should then be induced at once, as the chloride of silver formed is soluble in

solutions of sodium chloride and in the digestive fluids. Lavage of the stomach with a very soft stomach-tube may be carefully tried. If the stomach cannot be washed out, give large draughts of salt-water and produce vomiting alternately. Opium and oils may be given to allay the irritation, and large draughts of milk, or of soap and water, to dilute the poison and protect the mucous membrane of the stomach and œsophagus from the irritant action of the drug. The external bodily heat should be maintained.

CHRONIC POISONING BY SILVER NITRATE.—The prolonged internal use of any of the soluble salts of silver will give rise to chronic poisoning, or argyria. A local argyria, or argyrosis, may be caused by the frequent topical application of a soluble silver salt for a prolonged period. Discoloration of the conjunctiva and of the cornea has been observed. A few cases have been reported in which general argyria has resulted from the topical use of silver in the mouth and throat (Foster). The first sign of general argyria is the appearance of a slate-colored line along the gums, associated with some inflammatory swelling. Later grayish patches appear on the skin and mucous membranes, and spread over the whole body until the skin has acquired a peculiar bluish-slate color, which may become very dark, and in decided cases the conjunctivæ and the mucous membrane of the mouth are involved. The silver is found in all the tissues of the skin below the rete Malpighii (Frommann, Riemer, Neumann). No organ of the body, except the parenchymatous cells and the epithelium, escapes this pigmentation, which is due to the deposit of silver, in the metallic state, as an oxide or as some organic compound. Although the discoloration is long in making its appearance, the deposition in the tissues probably be-

gins at once and gradually accumulates. This condition of argyria does not seem to affect the general health. Foster believes that it is not improbable that in all cases a certain, though not serious, degree of derangement of nutrition is present in these cases.

Treatment of Chronic Poisoning.—Prophylaxis is most important. When the salts of silver are indicated as a treatment to be much prolonged, occasional discontinuance of the remedy is imperative. At the end of the third week of treatment, the remedy should be stopped for one week; after three months a long intermission should follow. E. Harnack (*Arzneimittellehre*, 410, '83) asserts that in every recorded case of argyria at least one ounce of the salt had been taken. In the intermissions of treatment by silver salts, the patient should receive a thorough course of purgatives, diuretics, and baths. Iodide of potassium may be given with the silver salts to expedite its elimination (Foster).

Greater or less success has been claimed for various treatments in argyria, but in general they are futile (H. C. Wood). Rogers claims that blistering will lighten the color. Eichmann recommends the use of potash baths and of soap baths, each four times a week. The internal use of potassium iodide may produce some change in the color of the skin, but perfect restoration to the normal is generally beyond a reasonable probability.

Therapeutics.—The silver salts are given internally for the relief of gastrointestinal and nervous disorders. The nitrate is most generally employed. It should be given in gastric disorders, in pill form, one-half to an hour before eating, that the stomach may be properly exposed to the medicament. In intestinal disorders the pills should be coated

with keratin, salol, or other substance not acted upon in the stomach.

GASTRO-INTESTINAL DISORDERS.—Nitrate of silver has been found of great value in the treatment of gastric ulcer, especially when combined, in pill form, with extract of hyoscyamus or opium.

Pyrosis is generally relieved by 1-grain doses of the oxide, given in pill form, a half-hour before meals. In dyspepsia, with yeasty vomiting, H. C. Wood has found that the use of the nitrate internally has given him the best results.

In chronic gastritis and gastric catarrh, when sour eructation or vomiting occurs after meals, the nitrate in doses of $\frac{1}{8}$ to $\frac{1}{4}$ grain, given an hour before meals, will yield good results. Forlanini, in these cases, irrigates the stomach with a solution of silver nitrate, following it immediately by irrigation with a solution of sodium chloride.

Catarrhal jaundice has been relieved by $\frac{1}{12}$ -grain doses of the nitrate. Bartholow advises the use of the nitrate in nervous dyspepsia, cholera infantum, and catarrhal jaundice.

In intestinal ulceration Pepper advised the use of the nitrate in keratin-coated pills.

In ulceration of the cæcum or rectum and in acute and chronic dysentery, rectal or colonic injections of nitrate of silver are very valuable. If the cæcum be involved a large bulk must be used to reach the seat of the trouble; if the rectum is the part affected not more than 4 ounces should be used. In either case the bowel should receive injections of warm water, that the contents may be removed, and the mucous membrane cleansed and prepared for the medication. If cæcal, use 1 drachm of silver nitrate to 3 pints of water; if rectal, use 3 grains to 4 ounces. If the latter is chronic and very obstinate, the strength

may be increased to 5 grains of the salt to 4 ounces of water. A solution of common table-salt should be at hand ready for use, and should be injected if the action of the silver is too severe, or to stop the action of the remedy when the desired effect is produced.

In typhoid fever Pepper highly recommended the use of the nitrate of silver ($\frac{1}{8}$ to $\frac{1}{4}$ grain, in pill) throughout the course of the disease. He believed that it modified the severity of the disease.

The oxide of silver has been used as an alterative in doses of 1 grain, given three or four times daily.

NERVOUS DISORDERS.—Silver is claimed to be the only remedy of any use in the treatment of anterior and posterior spinal sclerosis, and it has not always yielded success; the nitrate in $\frac{1}{4}$ -grain doses or 1 grain of the oxide may be given three or four times daily.

In epilepsy and chorea silver has been largely used, but it seems to do little good in most cases. Murray (Lancet, Sept. 21, '95), however, reports good effects and some cures from its use.

In locomotor ataxia Curci claims good results from the use of the double salt: sodium and silver hyposulphite. He gives daily from $\frac{3}{4}$ to 3 grains by mouth or from $\frac{1}{8}$ to $\frac{3}{4}$ grain hypodermically. He claims that it does not stain the skin (argyria).

EXTERNAL USES OF SILVER.—Silver nitrate has a wide range of usefulness in its external applications. It is employed as an escharotic, irritant, stimulant, alterative, astringent, and antiseptic.

SURGICAL DISORDERS.—The solid stick, or lunar caustic, has been found useful in stopping hæmorrhage from leech-bites. Fissures of the lips, tongue, nipples, rectum, and mucous patches and ulcers of the mouth yield kindly to applications of a 60-grain solution applied

carefully on a pledget of cotton or by means of a camel's-hair pencil. In some cases the solid stick does better.

Boils and felons may be aborted by an early application of a strong solution of silver nitrate.

Ulcers and suppurating wounds are benefited by applications of silver nitrate. The surface of indolent ulcers may be touched lightly with the solid stick, or a line may be traced within and parallel to the margin of the ulcer every day or two, the ulcer being strapped with diachylon adhesive plaster during the intervals and the limb dressed with a roller bandage. The healing of suppurating ulcers and wounds, with large flabby granulations, is hastened by an application, every day or two, of the solid stick or strong solution. Indolent sinuses from buboes or from abscesses may be stimulated to healing with a strong solution or the solid stick.

Bed-sores may be aborted if, as soon as the surface reddens, it is brushed over with a solution (20 grains to the ounce) of silver nitrate. This treatment is of no avail in paralytics.

Lymphangitis of the forearm resulting from a poisoned wound of the finger may be cured by applying the solid stick over the lines of inflammation.

Spasmodic oesophageal stricture has been relieved by the use of a sponge probang saturated with a very weak solution of silver nitrate.

PHARYNGEAL AND LARYNGEAL DISORDERS.—Inflammations of the pharynx, larynx, and fauces are amenable to applications of silver nitrate in varying strengths. An attack of acute pharyngitis may be aborted by the early application of a 60-grain solution. In laryngitis the parts should be cleansed with an alkaline solution, the parts anæsthetized by a solution of cocaine, and by the

aid of a brush and mirror a 10- or 20-grain solution applied to the larynx.

In laryngeal phthisis a spray from an atomizer in the strength of $\frac{1}{2}$ to 2 grains to the ounce may do good service. Incidentally we note that Crocq, of Brussels, claims that silver nitrate is a valuable remedy in phthisis, promoting appetite and digestion and diminishing cough, expectoration, and night-sweats. He administers from $\frac{1}{7}$ to $\frac{1}{3}$ grain daily, in divided doses. It may, with advantage, be given in $\frac{1}{6}$ -grain dose combined with 3 grains of Dover's powder, as originally suggested by P. A. Brady.

In pertussis Ringer advises the use of a spray of silver-nitrate solution ($\frac{1}{2}$ to 2 grains to 1 ounce) to relieve the violence of the cough and give the patient a good night's rest. The spray should be used when the stomach is empty, as it may bring on retching. The nozzle of the atomizer should be placed well within the mouth to prevent staining of the skin.

OPHTHALMIC DISORDERS.—Silver nitrate is found useful in ophthalmological practice in all strengths from a 1-grain solution to the solid stick.

In simple conjunctivitis, where the discharge is profuse, a 2- to 5-grain solution will be found useful.

In purulent or gonorrhœal ophthalmia, when the discharge is profuse, the lids should be everted and wiped dry, and brushed with a 10- to 20-grain solution of silver nitrate, immediately neutralized with a solution of common salt. This should be done once daily.

Granular lids and trachoma are benefited by silver nitrate; if there is slight discharge the stick will be found beneficial; if there be much discharge the use of a 10-grain solution, with neutralization of excess, once daily will be followed by improvement.

In diphtheritic conjunctivitis, after the absorption of the membrane and the re-establishment of the discharge, use cautiously nitrate-of-silver solution as in purulent ophthalmia.

Credé has urged the use of a 1- or 2-per-cent. solution, 1 drop in each eye, in the eyes of all newborn infants to prevent the occurrence of ophthalmia neonatorum. We believe the treatment should be restricted to those cases in which the mother is suffering from some ichorous leucorrhœal discharge. It is not to be commended as a routine procedure.

The use of silver should be interdicted where corneal ulceration exists, and when continued use of a remedy is desired. The danger of permanently staining the tissues must not be forgotten.

CUTANEOUS DISORDERS.—It is claimed that pitting in small-pox may be prevented by puncturing the vesicles, on the fourth or fifth day, with a needle dipped into a 4-per-cent. solution of nitrate of silver. Others paint the skin with a 1- or 2-per-cent. solution, and claim that it is equally effective. Shoemaker suggests the use of the mitigated stick.

John Higginbottom urges the use of silver-nitrate solution (160 grains to the ounce) in the treatment of erysipelas. The part is well washed with soap and water, then with pure water, and finally wiped dry with a soft towel. The solution is then to be applied two or three times on the inflamed surface and beyond it, on the healthy skin, to the extent of two or three inches. Others suggest outlining the affected patch with a broad line to limit the spread of the disease.

Nitrate of silver is used to destroy parasitic fungi, to cause exfoliation, or for a stimulant effect. As a caustic it is inferior to several other caustics. It has been found useful in some forms of eczema (chronic forms and circumscribed

patches) and in relieving the itching of prurigo and lichen. Pruritus pudendi vel ani et vulvæ may be benefited by a 4- or 6-grain solution painted upon the parts two to four times daily.

The use of silver nitrate has been recommended in lupus, psoriasis, erythema, and ringworm.

VENEREAL DISORDERS.—In the treatment of buboes Cordier reports excellent results from injections of a 2-per-cent. solution of silver nitrate in the early stage.

In orchitis and epididymitis a strong solution of the nitrate painted over the scrotum, in the early stages, will often relieve the pain and swelling.

Injections of nitrate-of-silver solutions are most useful in the later subacute stages, in the strength of $\frac{1}{2}$ grain to 3 ounces. Strong solutions used early have been advised for the purpose of aborting the disease; such use is not to be commended or indorsed.

GYNÆCOLOGY.—In uterine ulceration and in those cases of leucorrhœa where the cervix is boggy and tender, great benefit follows the application of the solid stick within the cervix uteri. This use is often followed by headache about the vertex, and this is, in turn, relieved by 10-grain doses of the bromides. Nitrate-of-silver solutions were used very extensively for erosions of the cervix, but other remedies have supplanted them. Vomiting of pregnancy is often relieved by brushing the cervix over with a 60-grain solution of the nitrate.

REMOVAL OF STAINS.—Several methods of removing silver stains from clothing: The stain may be washed with a solution containing $2\frac{1}{2}$ drachms of potassium cyanide, 15 grains of iodine, and 3 ounces of water. Another method is to dissolve 15 grains of corrosive sublimate in 7 ounces of boiled water, and

add about 45 grains of sodium chloride (table-salt) just before using; lay the stained materials in it for about five minutes and then wash them two or three times. Hahn advises the use of a solution containing 75 grains each of corrosive sublimate and of ammonium chloride dissolved in 10 drachms of water.

When the stains are older rub them with a mixture of iodine and ammonia, and while the part is still wet wash it thoroughly. This mixture, when dry, forms a highly explosive mixture.

Cyanide of potash will generally remove stains from the fingers or skin. The part should be well rinsed immediately afterward.

Unofficial Silver Salts and Compounds.

ARGENTAMIN is an 8-per-cent. solution of silver phosphate in 15-per-cent. aqueous solution of ethylene-diamine. It occurs as a colorless, alkaline liquid, miscible with water. It coagulates albumin but slightly. It is used externally, as an antiseptic and astringent, instead of silver nitrate or corrosive sublimate. It is also used by injection (1-10,000 to 1-4000) in gonorrhœa.

ARGONIN. — A soluble silver-albumin salt produced by the union of sodium-casein, silver nitrate, and alcohol. It occurs as a fine white powder, soluble in hot water. It is a non-irritant antiseptic, like argentamin. It does not coagulate albumin of the tissues, and is said to be antidotal to the gonococcus. In the conjunctival sac it is no more irritating than water, but is said to yield good results in purulent and catarrhal conjunctivitis. It does not stain the clothing.

The following advantages are claimed for protargol and argonin over the older silver salts in treating the purulent ophthalmia of children: (1) quick destruction of the gonococcus, (2) the

earlier disappearance of the secretion and of the inflammatory process, and (3) the more prompt restoration of the injured cornea and other tissues to the normal.

Protargol is more powerful than argonin, and should not be used in greater strength than from $\frac{1}{2}$ to 2 per cent. Peck (Pediatrics, vol. vii, p. 129, '99).

LARGIN. — Largin is a grayish-white powder, very light; soluble in water, glycerin, blood-serum, albumin, alkali and acid albumins, and in solutions of peptone. It contains 11.1 per cent. of metallic silver.

It is of especial value as an antigonorrhœal remedy.

PROTARGOL — Protargol is a proteid compound of silver introduced by Neisser in 1897. It occurs as a light-yellow powder, differing from argonin in that it is freely soluble in water up to 50 per cent., forming a clear, light-brown solution. It contains 8.3 per cent. of nitrate of silver, whereas in argonin the proportion is 4.1 per cent. and in argentamin only 2.0 per cent. Its non-precipitation by solutions of albumin and chloride of sodium make it especially valuable in the treatment of gonorrhœa, and its neutral reaction renders it unirritating to the mucous membranes. It is used principally as an injection in gonorrhœa in solutions of $\frac{1}{4}$ (early stage) to 1 per cent. (later stages).

Fürst, of Berlin, has used a 10-per-cent. solution in ophthalmia neonatorum, and prefers it to silver nitrate. In acute conjunctivitis a 2-per-cent. solution is most satisfactory, although the strength may be increased to 10 per cent.

SILVER ARSENITE occurs as a yellow precipitate which may be decomposed with heat. It is used in skin diseases as an alterative and antiseptic. Dose, $\frac{1}{100}$ to $\frac{1}{60}$ grain.

SILVER CHLORIDE occurs as a white powder which blackens upon exposure to the light. Soluble in ammonia, potassium thiosulphate, and potassium cyanide. It is an antiseptic and nervous sedative. Used in gastralgia, diarrhoea, pertussis, chorea, epilepsy, and various neuroses. Dose, $\frac{1}{3}$ to $1\frac{1}{2}$ grains.

SILVER CITRATE occurs in white powder or needles, soluble in water. It is an antiseptic, and has been used as a dressing for wounds and for inflammation of the various mucous membranes. In acute gonorrhoea a solution of 1 to 8000, gradually strengthened, is advised.

SILVER LACTATE occurs in small, silky needles, soluble in hot water and in 20 parts of cold water. It is an antiseptic. For gargles and mouth-washes, solutions of from 1-4000 to 1-8000 are used. It will stain the skin.

Actol (silver lactate) is an exceedingly good antiseptic within the animal body, excelling corrosive sublimate. It, however, coagulates albumin, and thus cannot be used as a dusting-powder for wounds. Itrol (silver citrate) is also a good antiseptic, and can be dusted on a wound very thinly, but not daily. It may also be used for washing out cavities. Itrol dissolves in distilled water, 1 in 4000; and if a stronger solution is required actol should be used. Credé (*Archiv f. klin. Chir. B.* 55, H. 4, '96).

SILVER AND POTASSIUM CYANIDE occurs as white crystals, permanent in the light, and soluble in 4 parts of water. It is bactericidal and antiseptic. One part in 50,000 destroys anthrax bacilli. It is incompatible with acids and is very poisonous.

UNGUENTUM CREDE. — Unguentum Credé is a salve containing 15 per cent. of soluble metallic silver. The greatest care is needed in its preparation, in order to obtain the minute subdivision of the silver particles necessary for its absorption through the skin.

It is indicated in the treatment of acute suppurative processes, and should be thoroughly rubbed into the cleansed skin until it has approximately disappeared. This takes from twenty to thirty minutes. The amount to be used varies from 30 to 45 grains at each inunction.

The formula of unguentum Credé is as follows: 15 per cent. of soluble silver is incorporated in lard by the same method as is the mercury in gray ointment, and to the product 10 per cent. of wax is added. The ointment is flavored with benzoinated ether. From twenty to thirty minutes are required for inunction. This ointment is useful in acute suppurative processes, as phlegmon, lymphangiectasis and lymphadenitis, septicæmia, commencing osteomyelitis, phlegmonous angina, furunculosis, erysipelas, puerperal fever, and gonorrhoeal and articular rheumatism. In general sepsis, or when inunctions are not practicable, it may be given internally as a pill: soluble silver, $\frac{1}{4}$ grain; sugar of milk, $1\frac{1}{2}$ grains; glycerin, $1\frac{1}{2}$ minims, with sufficient water. Two of these may be administered twice or thrice daily, followed by from 3 to 6 ounces of boiled water or tea.

Pencils of 3 grains each are useful for fistula. In solution, 1 or 2 to 10,000, it may be used for irrigation. Of the strength of 1 to 500-2000, in severe sepsis it can be administered intravenously after the method employed by Baccelli for mercurial solutions. B. Credé (*Klin. ther. Woch.*, Nos. 14, 15, '98).

Credé's silver ointment has been found valuable in puerperal sepsis. This ointment is used once in twenty-four to thirty-six hours in acute cases and in chronic cases twice daily. It is rubbed into the body at some distance from the point of infection, and should be thoroughly carried into the skin and subjacent tissues. Results of the treatment are immediate improvement in the symptoms, beginning within from three to ten hours. In a personal case of septic absorption when the patient's condition was critical, between 1 and 2 drachms of

Credé's silver ointment were rubbed into the inner surface of the thigh, and repeated on the following morning. A rapid and marked improvement followed, the patient's temperature falling to normal and her pulse gradually improving. Five days afterward there was again fever and rapid pulse, when two inunctions were given twelve hours apart. After this inunctions were given daily in small quantity for four days, and then at intervals. Altogether about $1\frac{1}{4}$ ounces of the ointment were employed. Patient made a good recovery. Jones (Obstetrics, No. 2, '99).

Colloid silver is tasteless and unirritating and is a powerful antiseptic. The streptococci combine with it chemically and a silver salt is formed which is exceedingly destructive to germs. It is of great value, particularly in infected wounds. The usual forms of antiseptic solution, such as mercury and iodoform, are toxic, but silver is harmless. It is useless when administered by the mouth or by subcutaneous injections; the only method of administration is by inunction. It may be given by intravenous injection. It is employed in acute rheumatism, gangrene, typhoid fever, scarlet fever, and septic complications. Experiments upon animals show quite as favorable results as in the human. The silver is absorbed and eliminated rapidly, and the inunctions must be repeated three or four times a day. Credé (Berliner klin. Wochen., Sept. 16, 1901).

The intravenous plan is the best. From subcutaneous injection absorption is slow and silver is often deposited. *Per os* the best method is to mix the colloid silver with mucilage. In this way 50 per cent. can be recovered from the stools in the original form. This method is of great use in intestinal disorders. After a large dose, injected intravenously, silver can be demonstrated microscopically in the liver, spleen, and intestine, but not in the kidney. Beyer (Münchener med. Wochen., No. 8, 1902).

Series of cases treated with Credé's ointment, which had a most satisfactory outcome. They included acute septic phlegmon, chronic osteomyelitis, erysipelas, puerperal fever, mastitis, and

chronic furuncle. The inunctions were made with care, from fifteen to twenty-five minutes being employed in rubbing in the remedy. The quantity used varied from 30 to 45 grains. In rubbing in the ointment a linen-covered cork with rounded edges was used. After the inunction the part was covered with rubber tissue. The results were good in arthritic rheumatism, the effusion disappearing quite as rapidly as under other methods of treatment. Rommel (Therap. Monats., No. 10, p. 330; Medicine, Mar., 1904).

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SINUSES, DISEASES OF.

Ethmoiditis.

Definition.—This term is used by some authors to designate inflammation of the middle turbinated body in connection with ordinary chronic rhinitis, while others appear to restrict its use to inflammation beginning within the ethmoidal labyrinth. It is evident that two processes, perhaps radically different, are concerned here, each of which has been associated with the term ethmoiditis. In the first place, in chronic rhinitis, under some circumstances, the inflammation of the mucosa of the middle turbinated bone extends by contiguity to the subjacent bone, producing a sort of fungous osteitis, with more or less suppuration, dry caries, or osseous hypertrophy; further extension by continuity involves the ethmoidal cells; so that there is increased production of granulation-tissue and pus, which latter may become pent up. This process, thoroughly ingrafted upon the ethmoid, may play a very prominent part in settling up antral or frontal-sinus disease, and also in the formation of mucus polypi. The other conception of ethmoiditis has reference to the endogenous production of suppuration, such as occurs in all the other

sinuses. Here we understand that the process starts from within the labyrinth, through invasion of the labyrinth during a special rhinitis, or influenza, etc.; the accidental presence of pyogenic germs in the labyrinth roused to activity by repeated attacks of severe coryza, and finally infection of the labyrinth by pus from one of the other sinuses. The process once established within the sinus, it may readily extend through its wall and attack the middle turbinated bone.

While both varieties of etiological factors are competent to cause ethmoiditis, the fact that suppuration of the ethmoidal cells is much more common than suppuration of any of the other sinuses would seem to prove that its great frequency here is due to the fact that the ethmoidal cells are particularly liable to inflammatory action because of their relation to the middle turbinated bone.

Symptoms.—The superficial form of ethmoiditis is simply one of the phenomena of chronic hypertrophic rhinitis with enlargement of the middle turbinate body. The symptoms of this affection belong, therefore, to chronic rhinitis, and also, in part, to intranasal mucous polypi. As far as the affection is a purulent one, the symptoms consist of a unilateral purulent discharge, or in some cases of the escape of a large quantity of pus after removing some portion of the middle turbinated body.

In cases of suppuration of any of the sinuses acute exacerbations are common; so that such symptoms as tenderness, localized pain; neuralgias of the cheek, eye, and forehead; nasal obstruction, together with unilateral discharge of pus, will at once call the attention of the observer to the probability of sinous suppuration. It remains to determine from which cavity the pus emanates. But,

since it is true that very frequently two or more of the sinuses on the same side are involved, it will readily be seen how difficult such a task is. It is of very little value to note the exact point through which the pus enters the nostril in determining which sinus is affected, because the middle turbinated blocks the middle meatus in so many different ways that pus may easily appear to emanate from the antrum when actually it flows down from the ethmoidal cells,—and the reverse is also true. Of much more importance in diagnosing an ethmoiditis is it to note whether the middle turbinated bone is enlarged and congested; and whether fungoid granulations or polypi have developed. We should not expect that a suppurating process of the ethmoidal cells be present if the middle turbinated bone is normal in appearance.

As regards the co-existence of ethmoidal and antral suppuration, we believe that involvement of the ethmoidal cells is by far the most common of sinus suppurations, and that, very frequently, the test of transillumination shows the antrum to be the seat of empyema when this cavity is only a receptacle for the pus which flows down over the outer wall from the ethmoidal cells above. This test is useful not only in diagnosing antral disease, but the electric light in the mouth frequently presents a shadow on the side of the nose where there is a suppurating ethmoiditis, or where the middle turbinated bone is largely hypertrophied.

Etiology.—If the outward origin is the correct view, the cause of ethmoiditis is simply a chronic rhinitis attacking the middle turbinated body; it is a complication or sequel of chronic rhinitis just as is the tumor-like hypertrophy of the posterior end of the lower turbinate

body. Wright believes that pus from the frontal or maxillary sinus flowing over the mucosa of the ethmoid region may set up suppurative ethmoiditis from without, accompanied by that œdematous condition which precedes the formation of mucous polypi. The weight of analogy would seem to require that suppurative processes should begin within the ethmoidal labyrinth; but clinical evidence appears to show that superficial ethmoiditis is much more common than the deeper form, which involves the labyrinth (Wright). A compromise view is furnished by Grünwald, who disputes the claim that intranasal pus (when not due to ulceration) must have been formed in a sinus, by stating that pus is readily formed behind any obstruction in the middle meatus. The most satisfactory view, therefore, is that hypertrophy of the middle turbinated body is not necessarily due to purulent inflammation, but that it favors the formation of pus by causing stagnation of the secretions. As far as we know, there is no direct proof that the fungoid granulations and polypi, the bone-cysts, dry caries, etc., are of pyogenic origin. To sum up, suppurative ethmoiditis is a term which may embrace two different processes. In ordinary hypertrophy of the middle turbinate, polypus formation, etc., pus readily forms as a result of stagnation of secretions from obstruction; while exceptionally suppuration arises from within the labyrinth just as it may within the sphenoid or other sinuses. In the first case—so-called superficial ethmoiditis—the exact part played by the pus is obscure. In the second case (deep ethmoiditis) there is no doubt whatever that the affection is primarily purulent and that the pus is responsible for all the phenomena.

Treatment.—The treatment of eth-

moidal suppuration will, from what has already been said, naturally necessitate the cure of the chronic rhinitis which may be present. Careful study will show why inflammation of the ethmoidal cells has occurred on one side of the nose rather than the other. Deviations of the septum, spurs on the septal partition, or a long-continued hypertrophy of the inferior turbinated body, each producing general congestion, causes an interference with the nasal respiration, circulation, and drainage. These are all competent to cause inflammation and hypertrophy of the middle turbinated bone, and their evil effects should be corrected by removing them with saw, scissors, galvanocautery, and chromic acid. Cauterizing sensitive areas in patients constantly predisposed to acute coryzas is also of use in preventing extension of inflammation to deeper parts. Acute suppuration of the ethmoidal cells, unless a chronic empyema of some other sinus is present, may be prevented from becoming chronic unless there is already radical change in the middle turbinated.

Treatment of ethmoiditis includes the removal of mucous polypi and the reduction of the general fungoid granulations which cover the anterior, internal, and posterior face of the middle turbinated. This tissue is most easily removed with nasal scissors and with cutting forceps. The galvanocautery is not a useful instrument in this location. After projecting tissue has been removed by cutting, it can still further be reduced in size by one or two applications of chromic acid. Such preliminary work as this will frequently so improve the condition of the middle turbinated as to cure the suppurating surface in the ethmoidal labyrinth. But there are many cases that will require more radical treat-

ment; that is, removal of the anterior and external portion of the middle turbinated bone with the cold snare or crushing forceps, so that the ethmoidal cells may be reached, more perfect drainage established, and necrosed bone removed by careful curetting. Once this operation is commenced, great care should be used to secure drainage from above downward in order to prevent sepsis and possible dangerous inflammation of the meninges or of the orbit. It will require the best of judgment to determine when nasal irrigation should give place to the soothing effects of oily sprays or quieting powders. When the antral cavity is filled with pus derived from the ethmoidal cells, that, too, should be drained by an opening through its floor or its internal wall.

Report of 4 cases of emphysema of the upper eyelid from nasal lesions, probably due to perforation of the wall of the orbit near the middle, whence the air at once enters the space between the orbital periosteum and the first fascia of the eyeball. In ethmoid operations the curette is responsible for much of the traumatism occurring to the lamina papyracea. Alligator forceps or cutting forceps are less apt to perforate, and will equally well drain pus or remove polypi as well as the mucous membrane lining the ethmoid cells.

Removal of any part of the middle turbinate should be avoided, since it forms a very important guide along which an operation may be carried out without risking entrance either in the orbit or brain-cavity in operations on the ethmoid. Abscess, destruction of the eye, and possibly meningitis may arise from septic conditions in operations carelessly done upon the ethmoid bone. Beaman Douglass (N. Y. Med. Jour., Mar. 23, 1901).

Inflammation of the Sphenoidal Sinus.

This affection, while not uncommonly

recognized post-mortem, is indefinite as to symptomatology during life, although now and then individual instances of correct diagnosis occur.

Symptoms.—Suppuration of this sinus is often suspected in protracted suppuration from the nose when other causes can be excluded. Some of the more radical rhinologists have advocated the removal of the turbinated bodies in cases of this sort, so that the region of the sphenoidal and posterior ethmoidal sinuses may be brought within the range of ocular inspection and of free use of the probe and curette.

It is very unlikely that these sinuses are ever the seat of an isolated suppurative process. We would naturally expect to find more or less disease of the nasal fossæ and other sinuses. In free suppuration from these sinuses the pus is naturally discharged into the naso-pharynx. In sphenoidal abscess the retention of pus may cause intracranial and ocular symptoms. The most significant symptom, however, would seem to be pus flowing down the posterior wall of the pharynx, which can be traced up to and over the body of the sphenoid into the posterior nasal cavity.

Treatment.—No one would advise curetting in a location so dangerously near the brain, but it is possible that a probe could be carried through the anterior nares behind and above the middle turbinated against the anterior face of the sphenoidal sinus, and in this way carious bone might be appreciated, drainage improved, and the cavity suitably washed.

Inflammation of the Frontal Sinus.

While authors describe acute catarrhal and acute purulent inflammation of these cavities, such affections are as yet insignificant from a clinical stand-point, unless a frontal abscess should chance to

form from obstruction of the outlet of the sinus. We shall, therefore, restrict our observations to the subject of purulent inflammation, either free or latent.

Symptoms.—The symptomatology of free suppuration of the frontal sinus is unsatisfactory and the diagnosis is usually made by the exclusion of ethmoid and antral suppuration—no easy task, especially as the two latter sinuses may themselves be suppurating. The pus in some cases drains away continuously, while in others it seems to collect slowly and produce local symptoms of pain, tenderness, aprosexia, etc. Under the latter circumstances the pus, after filling the sinus, may escape *en masse*, with marked relief of symptoms. When the exit is completely obstructed, as it may be from polypi, etc., a frontal abscess forms, recognition of which is comparatively easy.

Etiology.—The cause of suppuration of the frontal sinus is largely a matter of conjecture. Doubtless, such attacks often follow a severe coryza; but, as this affection is not believed to be due to pyogenic bacteria, the connection between the two is not apparent. Influenza appears to be able to provoke the disease in many instances; but, in all cases in which suppuration of this sinus follows a severe coryza or influenza, the predisposition must be no inconsiderable factor. If a few pyogenic cocci were present in the sinus, repeated attacks of simple inflammation or perhaps a single intense attack might be sufficient to develop the virulence of the germ and produce suppuration; or in case of any serious intranasal affection involving the middle meatus such as hypertrophic rhinitis, polypi, ethmoidal or antral disease, if a pyogenic factor were present, infection could readily travel along the infundibular passage into the frontal

sinus. Summing up, there appear to be three modes of possible infection: I. Repeated attacks of severe coryza, such as occur in a nose with marked septal anomaly, may rouse local pyogenic microorganisms to activity. II. In the course of severe infectious diseases, such as scarlatina or influenza, the specific germ of the disease may establish a purulent focus in the sinus. III. If there is present anywhere in the nose or other sinuses a chronic suppurative process, especially in the neighborhood of the middle meatus, the infection might be propagated to the frontal sinus.

Treatment.—Since suppurative inflammation of the frontal sinus occurs almost always by direct extension from the nasal passages upward, it may reasonably be expected that when such abnormalities as polypi, deflected septa, suppurating ethmoiditis, antral disease, and any form of chronic rhinitis,—when all these have been corrected,—the frontal sinus will rapidly return to its normal condition without further treatment than the necessary cleansing. Unnecessary probing of the frontal region is injurious rather than beneficial. After proper surgical work has been performed to correct the nasal disease which has done the harm, sedative applications of suitable oils and quieting powders will do more to allay inflammation in the frontal sinus than will efforts to make high applications, astringent and cauterizing in character. The cases are very few which will require external operation to relieve retained pus. In two such cases seen by the writer a discharge through the natural opening was accomplished by hot fomentations, the patients being placed in a Turkish bath. Sprays of weak solutions of cocaine may be sufficient to free the passages into the frontal sinus.

Inflammation of the Antrum.

As in the case of the frontal sinus, the clinical pathology of this cavity consists principally of suppuration, either free or retained. Free suppuration causes intranasal symptoms, and this form is most frequently seen by the rhinologist. In suppuration with retention of pus from obstruction of the ostium maxillare, if the case is not already under the care of a rhinologist, a surgeon is usually consulted. Finally, there is a special form of maxillary suppuration occurring in connection with dental caries which is usually cared for by the dentist. The result of this clinical subdivision is a partition of the literature of the subject, and somewhat contradictory accounts of the causes, symptoms, etc., of this affection. Most rhinologists see but little of that form of suppuration caused by alveolar caries.

Symptoms.—A discharge of pus from the antrum flowing through the nasal passages produces sufficient irritation to cause localized congestion and swelling of the entire mucous surface; so that nasal obstruction is caused not only by the pus itself, but by the general swelling of the mucous membrane. The purulent discharge varies in color and thickness. During an acute exacerbation the discharge will be thin and perfectly yellow; when the symptoms subside, the pus becomes somewhat mixed with mucus, and so is thicker and less highly colored. Unlike mucus or thin mucopurulent secretion, a discharge of pus from the sinuses glues the handkerchief together. The discharge has little of the foetid odor noticed in a severe case of ozæna, but the odor is so peculiar as hardly to be likened to anything else. The olfactory sense of the patient is not much blunted; so that he notices the odor more than does the patient suffer-

ing from different forms of caries of the nasal passages.

Diagnosis.—A unilateral discharge of pus from a nostril immediately suggests ethmoidal or antral suppuration, or both. Since, in our opinion, ethmoidal suppuration is the more common form of the two, it will be well to exclude this affection before deciding that the pus originates in the antrum. As has been said, it is not enough to find by transillumination that a maxillary sinus is filled with pus to conclude even then that this is the primary trouble. We may, perhaps, exclude ethmoidal suppuration by noting that there is no special abnormality of the middle turbinated bone, no fungoid granulation or polypi, and that the probe cannot reach carious bone in the region of the middle meatus or ethmoidal cells. The fact that the pus enters the nostril from above or below the middle turbinated bone is not specially significant. A history of dental trouble, the location of pain about the cheek rather than over the supra-orbital ridge, will point to antral suppuration rather than to ethmoidal trouble. Another difference between the discharge from the antrum and that from the ethmoidal cells is that, while in the latter the flow is quite constant, in the former pus is present in the nostrils when there is overflow or when the head is bent forward or carried to the side. The discharge is more or less intermittent. The symptoms of pus confined in the antrum are much more positive, and are those of pressure and distension of the sinus and cheek. Sometimes the enlargement of the face on the affected side is very noticeable. There are cases where pus has been found by an exploratory needle passed through the middle meatus into the antrum in which the test of the electric light gave no symptoms.

Etiology.—The pyogenic bacteria which cause antral suppuration may be accidentally present; repeated attacks of severe coryza, such as occur when obstructive deformities are present, may, then, by extending into the sinus, rouse them to activity. In the severe types of infectious disease—such as scarlatina, measles, whooping-cough, and influenza—these specific germs may gain entrance into the antrum by extension along the mucosa, and incite an acute suppuration, which may persist as a purulent focus. Another frequent mode of origin would seem to be the following: Whenever pus is present in the middle meatus from any cause, and especially in connection with suppuration of the ethmoidal sinuses, it can readily drain into and infect the antrum. Extension of suppuration from the roots of carious teeth, as well as trauma of all sorts, disease of the superior maxillary bone, etc., also cause suppuration of the sinus.

While theoretically these would seem to be the reasonable causes of antral disease, yet the relation of antral suppuration to pre-existing nasal disease is less apparent and direct than is ethmoidal suppuration to middle-turbinated inflammation. We can hardly realize a severe middle-turbinated affection which might not eventually involve the ethmoidal labyrinth. But in the case of the maxillary sinus, while theoretically it is easy to understand the extension of inflammation from the middle meatus through the maxillary opening, yet the antrum seems anatomically to be a cavity more isolated and consequently not sharing so intimately in nasal inflammations as do the ethmoidal cells. We can also understand that a rhinitis excited by a specific bacillus, as in the intense coryzas of an eruptive disease, may involve the antrum; but our experience would seem

to confirm the belief that, where suppuration of the antrum exists alone or precedes the suppuration of any other sinus, it originates quite as often from caries of the teeth or disease of the superior maxilla as from the ordinary forms of rhinitis. There are a large number of cases of empyema of the antrum which are clearly secondary to ethmoidal suppuration, in which case the antrum is filled with the pus, which runs down from the ethmoidal cells over the outer wall. Transillumination often shows the maxillary sinus clouded when there have been no acute symptoms about the cheek which would indicate active inflammation.

Many authors speak of diseases of the middle meatus as competent factors, but such affections are vague and are seldom appreciated except as associated with suppurative ethmoiditis and polypi. The most common source of pus in the antrum is, first, from the ethmoidal cells above; second, the form of suppurative inflammation caused by carious teeth; and, last, a secondary involvement of the antrum from especially severe forms of rhinitis.

Treatment.—The antral cavity must necessarily be drained of pus and thoroughly disinfected whether it be the primary seat of trouble or secondarily involved. When it is simply the receptacle of pus from other sources, washing alone with suitable disinfecting solutions—such as a 10-per-cent. solution of boroformalin or borolyptol, 1 to 10,000 mercuric bichloride, Seiler's or Dobell's solution, 10-per-cent. solution of peroxide of hydrogen—will be sufficient for the treatment of this cavity while other forms of intranasal disease are being remedied. But when there is a suppurating focus in the antrum itself, and the lining walls of the cavity have degenerated into fungoid granulations and

polypi, it will be necessary to make the opening into the antrum so large that a curette can be used and that suitable dressings can be employed. If the teeth are perfectly good on the affected side and the pus in the antrum is from other sources, then it may be sufficient to make the opening into the antrum through the middle meatus. The cavity may be washed out by means of a small tipped syringe, or a small-sized Eustachian catheter. But where degenerative changes have taken place in the antrum, and especially where there is evidence of dental disease, an opening made by trephining through the alveolar process will be much more satisfactory. After such an opening has been made the patient may be sent to the dental surgeon, who fits a suitable metal tube into the opening long enough to extend from the alveolar process above the floor of the antrum, so as to avoid clogging of the inner opening. This tube is held in position by a clasp about the nearest tooth. Disinfecting washes should be employed several times a day in the beginning, but later the strength of the solution should be diminished and they should be employed less frequently until the cessation of the pus through the tube will allow the intermission of all washes. Sometimes after long washing such powders as bismuth, boric acid, aristol, and alum—a proper combination of all of them—will aid materially in restoring the lining of the antrum to a normal condition. Extensive curetting will sometimes be found necessary.

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SKIN, DISEASES OF. Treated under individual headings: ACNE, ECZEMA, etc.

SKIN-GRAFTING.—When skin-grafts are obtained from the patient himself, they are called autografts; when from another person, heterografts; and when from animals, zoögrafts. The best results are derived from autografts. Heterografts grow better than zoografts, but it must not be forgotten that they may cause disease, especially syphilis.

The Method of Reverdin.—With fresh wounds or healthy granulating surfaces little preparation is necessary. Ulcers should be clean and devoid of necrotic tissue; a good indication of fitness is the appearance of a pedicle of new skin around the edges. Desirable as asepsis undoubtedly is, in the majority of instances it cannot be obtained. It is sufficient that suppuration is not too profuse and infection not too virulent. If the circulation is impaired by surrounding cicatricial tissue or by varicosities, or if marked inflammatory changes are present, these conditions must be modified by incisions, moist compresses, rest in bed, etc. Pale, indolent, or exuberant granulations should be treated by cauterization, compression, etc. If strong antiseptics have been employed, they must be washed away before transplantation is begun.

The grafts, which are best obtained from the arm or thigh, should be about the size of a grain of wheat. They are cut by elevating a portion of skin with mouse-toothed forceps and dividing it with scissors curved on the flat, removing the entire epithelium and a portion of the corium without disturbing the subcutaneous fat.

The bits of cuticle adhere to the surface to be grafted, especially if gentle pressure with a pledget of gauze be employed. Nothing is gained by scraping or in any way wounding the granulations. The transplantations should be close to-

gether, as the greatest size to which a graft can grow is perhaps that of a silver dime.

Immediately over the grafts may be placed strips of rubber protective; or, better, a single layer of gauze, which may be pinned around a limb or fastened at the edges with collodion. The latter method is simpler and permits freer exit of secretions.

Whether the external dressing is moist or dry is usually of little importance, but no powerful antiseptic should be used. As there is generally some suppuration, it is necessary to change the superficial portion of the dressing every twenty-four hours at least, leaving in place the rubber tissue, or the undermost layer of gauze, as the case may be. Gentle irrigation with a solution of salt or boric acid assists in maintaining cleanliness.

The Method of Thiersch.—There is no process of skin-grafting so simple, so reliable, and so generally applicable as this. Granulating surfaces or fresh wounds may be covered with epithelium in from ten days to three weeks; cicatricial contractions are avoided; and in many cases the cosmetic value can scarcely be overestimated. The process is of great value in the treatment of ulcers, burns, and defects following operations or injuries. The grafts will adhere to periosteum; to bone from which the external surface has been removed; to tendons, fascia, dura mater, muscle, etc.

The patient is anæsthetized, and if granulations are present it is best to scrape them away with a sharp spoon down to the comparatively firm tissue beneath, although this is not absolutely necessary. Oozing is checked by elevation and pressure, an Esmarch bandage being unnecessary. The grafts are cut with a razor from the anterior surface of the thigh. An assistant makes the

skin tense by means of a hand on either side of the limb, while the operator, standing with his back toward the patient's feet, cuts toward himself, with his left hand stretching the tissues in the direction of the knee. With a backward and forward sawing motion it is not difficult to obtain shavings of epidermis an inch or more wide and several inches in length and as thin as paper, which is a desirable thickness. No appreciable scar results. The delicate strips fold up on the blade of the razor from which they may be spread directly upon the surface to be grafted, and so adjusted that they overlap each other and the edges of the skin, completely concealing the raw surface. Healing without suppuration is not uncommon. Next to the transplanted cuticle are placed strips of rubber tissue or a single layer of gauze, as described in the Reverdin method. If a moist dressing is employed, it should consist of a thick pad of gauze saturated with normal salt solution and covered with cotton and oiled silk. This should be removed often enough to keep it moist. A dry dressing answers equally well, applied as in the treatment of ordinary wounds.

The grafts do not become firmly fixed for nine or ten days, and it is well not to soak off the undermost layer of gauze for about two weeks.

The Method of Wolfe: Krause's Modification.—In this method grafts are employed which fill the entire defect, and which comprise the whole thickness of skin without including the subcutaneous tissue. In cutting the skin at least one-third must be allowed for shrinkage. Sutures are usually unnecessary and artificial heat is detrimental.

Wolfe's method has recently been modified and the technique improved by Krause, who employs spindle-shaped

grafts so that the wound produced by their removal may be immediately closed. The strips of skin, cut into smaller pieces if desirable, are accurately fitted into the defect, which is to be closed. The operation must be a "dry" one, and the raw surfaces of the skin should be handled as little as possible.

The Method of Hirschberg.—Believing that grafts subsist upon their contained fluids until new vessels are formed, Hirschberg beats the skin with rubber tubing until it becomes engorged before making a transplantation. He employs the entire thickness of the cuticle, including the subcutaneous fat. Sutures are often required.

Anomalies in Grafting.—Transplantation of mucous membrane may be made. It may be shaved off as in skin-grafting,—for instance, from the lips,—or it may be stripped off in its entirety.

More or less satisfactory results can be obtained by the use of shavings of callus from the palms of the hands or soles of the feet or from sections of corns. "Epithelial rods" from warts have been successfully used, as have also flakes of old, dried epidermis from various parts of the body; even "epithelial dust" scraped from the surface of the skin will often grow on a granulating wound. Deeper scrapings, drawing sufficient blood to form a paste, are said to be quite satisfactory at times (Mangoldt).

Grafting from dead bodies or from amputated limbs has frequently been resorted to, but the danger of carrying disease cannot be disregarded.

Sponge-grafting is now seldom employed. Very thin slices of sponge are sterilized by boiling, and placed upon the raw surface. The material acts as a frame-work only for the granulations, and is soon absorbed.

The idea of grafting from animals is

attractive, but the results are too uncertain, and the method has largely fallen into disuse. Skin has been obtained from frogs (abdomen), chickens (beneath the wings), pigs, dogs, cats, rabbits, guinea-pigs, etc. Cocks' wattles, sections of the testicles of rabbits, and the lining membrane of eggs have also been employed.

Histology and Pathology.—The existence of epithelial grafts may be said to be, for a time, parasitic. In the course of about eighteen hours vascular connections begin to form, firm adherence taking place by the tenth day. Successful grafts soon become pinkish in color. New skin arising from large grafts which cover the entire raw surface becomes in time movable, but that produced from Reverdin-grafts remains immovable, owing to cicatricial tissue between the individual bits of cuticle.

Hairs may remain where transplantations of the entire thickness of the skin are made, but they are apt to become deformed or fall out.

But little contraction takes place in the Thiersch and Wolfe-Krause methods, but in the method of Reverdin contraction is apt to be considerable.

Exfoliation of epidermis may occur in any form of grafting, but this does not necessarily mean that the grafts are dead. A remarkable phenomenon in connection with Thiersch grafting is the readiness with which depressions fill up to a level with the surrounding skin, especially about the face.

Comparison of Methods.—The simplest is that of Reverdin, although the new skin is often little better than scar-tissue. It should be reserved for cases where the rapid closure of a granulating surface is desired without reference to anything else.

It may sometimes be expedient to graft

from dead bodies or from amputated limbs; and occasionally use may be found for "epidermal scrapings," or for epidermis obtained from warts, corns, callosities, blisters, etc.; but one must not expect the results to be brilliant.

Thiersch grafting has a wider range of applicability than any other method, and its results are quite uniformly good, both functionally and cosmetically; but it must give way to the Wolfe-Krause proceeding where thicker skin is desired which more closely resembles the surrounding integument.

It is seldom, if ever, desirable to employ the method of Hirschberg.

The skin of animals does not compare in vitality with that taken from a patient's own body or from some other person. It is seldom necessary to transplant from mucous membrane, as ordinary Thiersch grafting answers the same purpose in nearly all cases.

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SKIN, SURGICAL DISEASES OF.

Milium.—Milium (grutum; strophulus albidus) is a cutaneous disorder characterized by the formation of small, roundish, whitish or pearly, sebaceous, non-inflammatory elevations, situated just beneath the epidermis, which are formed by the accumulation of inspissated sebum in ducts, the outlets of which have become occluded. They are mainly found on the face, eyelids, and foreheads of elderly persons; may exist in large numbers; and vary in size from a pin's head to a small pea. They may undergo calcareous degeneration, giving rise to cutaneous calculi. They differ from comedo in that the contents of the distended duct cannot be squeezed out until an opening is made. This affection is often associated with comedo and acne.

TREATMENT.—A small incision over the elevation will afford an exit through which the contents may be expressed by squeezing. After evacuation the interior should receive an application of lunar caustic (solid stick) or of tincture of iodine. If the general health be impaired, iron, strychnine, and codliver-oil are indicated.

Sebaceous Cysts, or Wens.—A wen (steatoma) is a cystic tumor varying in size from a millet-seed to an orange, formed by the retention of secretion in a sebaceous gland, and situated in the skin or subcutaneous structures. Wens occur most frequently on the scalp, face, back, and scrotum, and may be single or multiple. There is usually no alteration in the skin lying over the tumor; if the tumor be large, the overlying integument may be somewhat thinned and have a glazed appearance. Although the excretory duct of the distended gland is usually obstructed, an opening may persist large enough to admit a probe. The contents of these tumors are milky or cheesy in character, but, if the tumor be injured, inflammation and ulceration may follow, or in the aged the tumor may acquire a malignant character, degenerating into epithelioma.

TREATMENT.—A cure will be effected by making an incision in the skin down to the cyst and carefully dissecting out the cyst. Incision and mere evacuation of the contents are always followed by a return of the tumor.

Molluscum Contagiosum.—This affection, known also as molluscum epitheliale and molluscum sebaceum, is characterized by the formation of sessile or pedunculated tumors varying in size from a pin's head to a marble. They are yellowish white or pinkish in color, rounded or acuminate, imbedded within or projecting beyond the surface of the

skin, and have usually a dark-colored point at the apex, from which, on pressure, can be expressed a milky, curd-like, or cheesy substance. At first the lesions are quite firm, but they soften with age. After persisting for several weeks, they slough and disintegrate, or undergo slow absorption. The tumors give rise to no pain, are always discrete, may be single or multiple, and occur usually in children or young adults upon the eyelids, face, neck, breast, and genitals. This disease frequently affects several members of the same household, asylum, or school.

The color, the wax-like appearance, the umbilication, and the central aperture are the diagnostic features. From molluscum fibrosum it is distinguished by the absence of the central black opening in the latter and the more general distribution.

The disease is probably contagious, and is said to be due to a parasitic protozoön of the coccidium type.

Various authors claim to have discovered protozoa within the cells of the tumors. The author finds, however, that these peculiar structures are solely due to hyaline degeneration, and by a special stain he could accurately study the evolution of the so-called molluscum bodies from the normal basal epithelium. An interesting discovery which may explain the infectious nature of the disease is the finding of large numbers of staphylococci in the excretory ducts and the surrounding tissues. H. Herzog (Virchow's Archiv., vol. clxxvi, No. 3, 1904).

The prognosis is favorable, though the disease may persist for months or even years.

TREATMENT. — Thorough inunctions with white precipitate or sulphur ointment are efficacious in some instances; when they are not, each tumor should be incised, its contents removed, and the remaining cavity cauterized with nitrate

of silver. General tonics (iron, arsenic, and strychnine) are often indicated.

Furuncle. — Furuncle (furunculus; boil) is a local inflammatory affection of the skin, commonly involving a cutaneous gland or hair-follicle. It begins with painful induration, followed by heat, swelling, and inflammation; finally, the central portion of the skin dies and forms a slough, or "core," around which suppuration takes place, ending in the separation of the "core," the subsidence of inflammatory action, and the contraction and healing of the cavity by granulation, the whole process lasting from seven to ten days. If no suppuration take place, the affection is called a "blind boil." The favorite location of boils is upon the face, ears, neck, back, axilla, buttocks, scrotum, labia, perineum, and legs. They may be single or multiple, and may appear in "crops."

The symptoms of the affection are at first a local sense of irritation or discomfort, followed by a sensation of throbbing pain, which is often severe and lasts until suppuration and loosening of the slough have occurred, when it subsides. In some cases, the neighboring lymph-glands become enlarged, and fever and other constitutional disturbance result.

The diagnosis of the affection is usually easy. It may sometimes be confounded with carbuncle. General appearance, single opening, and circumscribed character usually distinguish the boil.

Improper diet and hygiene, nervous depression, overwork, too free indulgence in greasy foods and gravies, and irregular action of the bowels, local irritation, friction, and prolonged poulticing predispose to this affection. The entrance of pus-cocci into the skin is the essential or exciting cause of this disorder. Single boils are usually the result of

local irritation; their appearance in successive crops (furunculosis) is usually an indication of impaired health.

TREATMENT.—Removal of the cause and regulation of the diet claim first attention. Open-air exercise and tonics are useful in debilitated subjects. Strong ammonia, caustic potash, acid nitrate of mercury, and other forms of caustic have been used to abort in the early stage. Yeast, nuclein, quinine, and mineral acids have been given to prevent recurrence. Arsenic, with or without iron, is sometimes beneficial. The sulphite or hyposulphite of soda (15 to 30 grains every three hours), calx sulphurata ($\frac{1}{8}$ grain every two or three hours), or sulphur may be given internally. A solution of boric acid or of sublimate, a 10-per-cent.-salicylic-acid ointment, or a mixture of equal parts of ichthyol and collodion may be applied locally. White has used full doses of bichloride of mercury internally to prevent recurrence.

Hypodermic antiseptic injections into the very base of a boil or carbuncle, early in its history, is practically an unfailing means for aborting an attack, however severe. If a boil is small, 1 injection, or 2 from opposite directions, carried well in from points on the outer margin of the indurated area are commonly sufficient to kill the morbid process. It is not usually necessary to repeat the injections more than once, although occasionally a second or even a third treatment may be necessary. By carrying the needle well into the middle of the boil, near the base, the injection will escape through the crown of the boil, if suppuration is well begun, and thus a larger amount can be used with safety than at the very outset, when less is needed. It is commonly practicable to wash out the cavity with a sharp-pointed syringe and an antiseptic solution daily after the first treatment, unless the boil was aborted at the very onset without perceptible suppuration or necrosis of tissues. The after-treatment

consists in the application of cloths wrung out from hot, but weak, bichloride solution until the inflammation has disappeared, and all necrosed tissue has come away. Then a dry antiseptic dressing suffices. Lysol may be employed both for the hypodermic use and later dressing. In from twenty-four to forty-eight hours the pain from the boil or carbuncle is usually all gone, and active inflammation has ceased. William O. Stillman (*International Jour. of Surg.*, Aug., '99).

Heat is directly injurious to the microbes of furunculosis; active hyperæmia is induced, and the skin sterilized; the profuse sweating induced prevents rapid increase of temperature in the deeper tissues. The form of apparatus recommended is the calorisor of Vorstädter. The hot air is first applied around the circumference of the affected part, and then to the boil itself. Two or three applications are given on the first day, and one daily afterwards. Temperature of air, 120° C. If there is only one boil, one or two sittings usually suffice to prevent abscess. Reich (*Zeit. f. Diat. u. Phys. Therap.*, Mar., 1903).

Carbuncle.—**DEFINITION.**—Carbuncle (carbunculus; erroneously called benignant anthrax, or anthrax) is a hard, circumscribed, deep-seated painful inflammation of the subcutaneous tissue, accompanied by chill, fever, and constitutional disturbance, and attended almost always with circumscribed suppuration and the formation of a slough.

SYMPTOMS.—The local symptoms are heat and aching, with throbbing and great tenderness, which are often followed by pain and redness along the lymphatics of the part and pain and swelling in the nearest lymphatic glands. There is at first a chill, followed by a febrile movement, which is generally well marked, and often very severe. The constitutional symptoms resemble those of erysipelas very closely, and may be as severe as those of the severest forms of

that disease, and the consequences may be fully as grave and fatal.

DIAGNOSIS.—The size of the inflamed area, flatness of surface, multiple openings or points of suppuration and extensive slough differentiate carbuncle from furuncle. Carbuncle is single, furuncle generally multiple.

ETIOLOGY.—A lowered vitality from any cause predisposes to this affection. It is especially common in diabetes. It occurs, however, in persons who appear to be otherwise in perfect health, and in those suffering from acne and other skin disorders. Local irritation, injury, friction, and the predisposing causes of furuncle may be etiological factors. Microbic infection is generally believed to be the exciting cause.

PATHOLOGY.—The morbid process is first discovered as a circumscribed thickening and hardening of the deeper layers of the skin, attended from the beginning, or at least very soon, by redness and a slight elevation of the skin, increasing more or less rapidly in thickness and area, as well as in prominence, until, at the end of a few days, it has reached its full development. Its area is then more or less circular, varying in diameter from a half-inch to three or four inches or more. It is intensely congested, is surrounded with an areola of congestion and often considerable oedema, and forms above the surface a considerable elevation, which is sometimes conical, but more often flat, according to the size of the area involved, and presents on its surface a vesicle or group of vesicles, containing serum, blood, or pus. These vesicles soon rupture and discharge their contents, exposing, on the floor, a small round orifice, from which already a yellowish or grayish slough protrudes. The tissue between these orifices soon melts down and thus form an irregular exca-

vation, the floor of which is formed by underlying sloughing tissue. The slough which is thus exposed has been gradually forming, and involves the deeper cutaneous structures and sometimes subjacent parts; it consists, mainly, of connective tissue soaked with pus, and resembles in appearance wash-leather. It becomes, in a short time, gradually loosened from its bed, and is discharged through the orifice which has formed over it, leaving an excavation which becomes filled with granulations. The inflammatory thickening of the tissues diminishes and the parts become healed, leaving a permanent scar. Carbuncles are most frequently found in the median line of the trunk behind from the neck down, the shoulders, and buttocks; more rarely in the lip, scalp, or abdomen. Carbuncle lasts from four to six weeks.

PROGNOSIS.—Carbuncle is especially dangerous when located on the scalp, abdomen, and upper lip; in these locations it is apt to occur in young people, and usually runs an acute course and, as a rule, is fatal from pyæmia. The prognosis is grave when extensive and attacking the elderly, especially if complicated with Bright's disease or diabetes. The prognosis should always be guarded, even in the most hopeful cases. Death is not infrequent in the old and debilitated.

TREATMENT.—General tonics, like quinine and iron, with large amounts of nourishing food, are indicated. Opium or other anodynes may be required to relieve pain and procure rest. Stimulants should be given only when required.

In the early stage 10 to 20 minims of a 5- or 10-per-cent. solution of carbolic acid in glycerin may be injected into the central portion of the mass with the view of aborting the mischief. If seen later,

firm compression by straps of adhesive plaster applied concentrically may be made, leaving the central orifice free for the discharge of sloughs and applying an antiseptic dressing over the straps.

Another plan, applicable in the early or late stage as well: Place patient under an anæsthetic; freeze the parts to make them friable; make one long incision or several crucial incisions through the mass; remove all sloughs and decaying tissue with a sharp curette; disinfect, drain, and suture, as in an incised wound.

Another method of treatment is the application of warm, moist, antiseptic dressings, covered with thin rubber cloth or oiled silk, removing sloughs as soon as loosened, and using iodoform, aristol, euophen, or similar antiseptic powder freely. The use of poultices is harmful, and should be avoided.

The treatment used during the last five years in fifty cases of carbuncle consists in injecting into the diseased tissues an 80-per-cent., or even 90-per-cent., solution of carbolic acid. At an early stage 2 or 3 drops may be sufficient, but later 15 to 30 drops are needed. The skin is rendered anæsthetic with ethyl-chloride, and then the hypodermic needle is passed into the carbuncle and a little fluid injected; the needle is then partly withdrawn and passed in a different direction, but only one puncture is made through the skin. One injection generally suffices for a cure, but a second or third may be required. Care should be taken not to inject into a blood-vessel nor to injure a nerve. The results are very good, and the relief from pain is rapid. Manley (*Indiana Med. Rec.*, Dec. 16, '98).

Ecthol, both for internal medication and as an external application, has been found of value in carbuncles. It is given internally in doses of a teaspoonful every two hours, until the healing has been completed, the interval between the doses being gradually prolonged. The local treatment consists in free incision and

thorough evacuation of the pus-cavity by scraping. The wound is then carefully cleaned with peroxide of hydrogen and dressed with absorbent cotton saturated with ecthol. This dressing should be changed every four to eight hours. Creel (*Cincinnati Lancet-Clinic*, Apr. 29, '99).

Ichthyol is practically a specific in the treatment of carbuncles, applied pure, so as to cover the entire swelling, except the apex. Usually in twenty-four hours the discharge becomes more copious, pain and tension are relieved, and in a week's time or less the cure is practically complete. The apex on which the ichthyol is applied is covered with a piece of cloth greased with tallow. The application is renewed once a day. After three applications the surface should be washed thoroughly so as to remove the varnish-like coating which the ichthyol forms on drying, and a new application is to be made. R. B. McCall (*Med. World*, Oct., 1900).

Personal experience in the local treatment of carbuncle with liquid air has shown that this is by far the best form of treatment. It is less painful to the patient than any other form of treatment. Only one application is necessary; within twelve hours of the first application the pain entirely ceases, not to return again, and at the end of a few days only a small ulcer is left,—representing the tissue between the openings of the carbuncle,—which readily repairs with usual dressings. In the treatment of the carbuncle the spray is used, first projecting it into the openings and using the air quite freely; then quite thoroughly freezing the external surface, which must be well cleansed of discharge resulting from sending air inside of the carbuncle before freezing. After freezing, the carbuncle should be dressed with a dry absorbent dressing so that the discharge, which will be abundant and accompanied with considerable bleeding, can be readily absorbed. The reaction from freezing takes place in about twenty minutes, and it is to this extreme hyperæmia that the success of liquid air in the treatment of this affection is attributed

more particularly. A. Campbell White (Jour. Amer. Med. Assoc., Feb. 16, 1901).

Lightning-stroke.—The atmospheric discharge of electricity known as lightning may assume one of two forms. In the form known as "chain," or "bolt," lightning, the electricity has an extremely high potential, and a stroke under such circumstances is invariably fatal when the discharge passes through a living body. The form known as "sheet" lightning is a "brush" discharge of low potential, and is harmless. Thus, any effect from instantaneous death to momentary unconsciousness may follow the receipt of a lightning-stroke, the effect depending upon the potential of the current received. Other effects may be produced, as burns, superficial or deep; or paralysis of special sense or of general motion and sensation.

TREATMENT.—The immediate indication in these cases is the relief of shock. External warmth, stimulants, frictions with stimulating lotions, and, perhaps, artificial respiration will relieve the effects of the shock. Any burns present will demand the ordinary treatment of such injuries. Galvanism and the internal administration of strychnine are indicated for the relief of the paralysis.

Frost-bite.—Frost-bite, or pagoplexia, is an effect of cold exerted upon the extremities of the body or exposed portions, as the nose, chin, ears, hands, and feet, the destructive effects being either direct or, as more generally happens, indirect from inflammation. It occurs, to an injurious degree, chiefly in aged or very young persons, or in persons of depressed vitality, the frost-bite and resulting gangrene being more due to the habitual low vitality of the extremities than to the low temperature.

SYMPTOMS.—In the first degree of frost-bite there is a feeling of stiffness,

numbness, and tingling in the affected part. It is of a pale-bluish tint, and somewhat shrunken. In this state the vitality of the part is merely suspended, not destroyed. When reaction sets in and the circulation of the affected part returns, a burning, tingling pain is felt, the part becomes red, and shows some signs of inflammatory action.

In the next degree the vitality of the part is completely destroyed, and it appears at first blanched, white, and icy cold; later, when reaction sets in, it becomes livid and shrunken; sensation and motion are absent. When the part has become thawed, gangrene manifests its presence; the reaction is violent, the part may become either swelled and discolored or may shrivel and contract, and then quickly become black and dry, and eventually separate by the formation of a line of demarkation around it. Gangrene, as an exception, may not set in for some time, the parts in the meanwhile appearing quite healthy; then discoloration will be noticed, at first a bluish color, next dark blue, then black.

PROGNOSIS.—With proper care and treatment, the vitality of a part actually frozen may be restored; unskillful treatment may favor gangrene even when the parts are not in a state of congelation.

TREATMENT.—The indications are to restore gradually the heat-producing powers of the part and at the same time to repress any excess of reaction. The patient should be placed in a cold room, without fire, and the frost-bitten parts gently rubbed with snow, or cloths dipped in ice-water, and held between the hands of the operator; as reaction appears, the parts may be wrapped in flannel or absorbent cotton, and stimulants and warm drinks may be cautiously administered. If gangrene is present, or

if sloughing occurs during reaction, allow the dead portion to detach itself naturally, if it be of small size. Amputation may be required if the gangrenous part be of large size, and should be done as soon as the line of demarkation appears.

Constitutional Effects of Cold.—The effects of cold are at first stimulating, the pulse being increased in force and frequency. Then a feeling of heaviness and stupor comes on, which gradually changes to an overpowering desire to sleep. This, if yielded to, terminates in coma, and a speedy, painless death. "Cold-stroke," the opposite of "heat-stroke," is a sudden chilling by intense cold in which death is produced by cerebral anæmia; prolonged exposure to a less degree of cold induces death by cerebral congestion, while sudden exposure to warmth produces a fatal result from embolism; partial freezing causes capillary embolism which is usually followed by fatal congestion or sometimes anæmia (Keen and White).

TREATMENT.—If the person exposed to cold be apparently dead, he must be placed in a cold room the temperature of which must be very slowly raised. Frictions with snow or cloths wet with ice-water must be made, and artificial respiration begun. These means must be continued for several hours even if no sign of animation appear. Recovery after several hours of suspended animation is on record.

Keratoses Senilis.—This affection is a cornification of the skin of old people, general or partial, circumscribed or diffuse, and often limited to definite regions, most commonly the face and the dorsal surfaces of the hands and feet, and sometimes the forearm and chest. The lesions consist of light- or dark- yellowish brownish points, dry scaling and

horny, or scaling and greasy, aggregated in masses of an irregular circular or oval outline. The surface of these masses is insensitive, and may project about an eighth of an inch above the surface. These masses may be readily picked off, leaving a small, superficial, smooth, excoriated surface or one covered with minute conical elevations (enlarged sebaceous glands). This affection rarely appears before the fiftieth year, and may not claim attention until fifteen or twenty years later.

PATHOLOGY.—On microscopical examination we find that their bases and the surrounding tissues are in a condition of senile atrophy, with pigment-cells deposited about the vessels; the sebaceous glands are hypertrophied and the lumen of their ducts diminished. The cutaneous papillæ are normal, the bulk of the masses being pigmented epithelial cells (Keen and White).

PROGNOSIS.—The prognosis is favorable if the proper treatment is promptly applied. When left alone the pigmented masses are prone to epitheliomatous degeneration, and may become foci for carcinoma of the face, in which case the dry scales are displaced by a scab, the tissues become hard, and growth is more rapid.

TREATMENT.—In the early stage,unctions with vaselin or olive-oil and the subsequent use of soap and warm water will remove the trouble. When the masses are firmer, ointments should be applied at night, and soft soap or sapo viridis in the morning, removing the soap by careful washing with clean, warm water; applications of diachylon ointment will heal any excoriations that may have been produced. When marked projection of the mass is present, the thorough use of the curette, or nitric acid on a pointed stick well worked into

the parts, will remove the affected tissues. If epitheliomatous change is suspected, prompt excision is indicated.

Clavus (Corn).—Clavus is an hyperplasia of the corneous or horny layer of the epidermis, in which there is an ingrowth as well as an outgrowth of horny substance, forming circumscribed epidermal thickenings, chiefly about the toes. Corns may be hard or soft, the latter being situated between the toes, where they become softened by maceration. Both forms are caused by intermittent pressure and friction. Pressure produces pain by driving the conical mass of hardened epithelium down upon the sensitive corium; constant irritation may produce inflammation and suppuration.

TREATMENT.—The use of well-fitting, comfortable shoes made on properly-shaped lasts is the first indication. Temporary relief from hard corns may be obtained by the use of felt rings which are applied over the corns, allowing the latter to project through the opening, so that pressure is removed from the corn and distributed around it upon the healthy tissue. Prolonged soaking in a warm solution of washing-soda will soften the corn, when it may be removed by gentle scraping with a sharp knife; the tender surface left may be protected by covering it with a plaster of salicylic acid or of salicylic acid with cannabis Indica. Another method is that of hardening the surface of the corn by applications of the tincture of iodine or nitrate of silver at night, removing the hardened tissue on the following morning. A third method is the use of the salicylic-collodion mixture: Salicylic acid, 30 grains; tincture of iodine, 10 minims; extract of cannabis Indica, 10 grains; collodion, 4 drachms; this to be painted on the corn night and morning for several days and then removed with

the corn, by soaking in hot water. Soft corns are best treated by gentle scraping to remove the softened epithelium, the surface being then protected by a pad of natural wool (as it is clipped from the sheep), or of absorbent cotton, having previously dusted the surface with a powder composed of equal parts of oxide of zinc and boric acid. When corns become inflamed, rest and warm, moist, antiseptic dressings meet the indications. If pus has formed, it must be afforded an exit. Corns should never be cut too closely, as erysipelas and gangrene may follow, especially in the aged.

Verrucæ.—Verrucæ (condylomata; warts) are circumscribed papillary excrescences on the skin, variable in color, smooth at the summit, or studded with moniliform elevations or with clusters of minute, pointed, horny filaments. They may be single or multiple, hard or soft, rounded, flattened, or acuminate. They may rapidly attain their full size, may last indefinitely (*v. perstans*), or spontaneously disappear, at any stage, and are not contagious. If picked or wounded, warts bleed freely, being often very vascular. The etiology of warts is obscure.

PATHOLOGY.—Warts consist of an hyperplasia of the papillæ, of the blood-vessels, and of both the rete mucosum and the corneous layer of the epidermis. The common wart (*v. vulgaris*) commonly found upon the hands of children, but occurring on other parts and at any age, form flattened or semiglobular excrescences varying in size from a pin's head to a half-inch or more in diameter. At first they are of the same color as the adjacent skin, later they become darker and harder, and the elongated papillæ, covered at first with cornified epithelial scales, may become partially denuded and appear like a number

of projecting-points walled in by a rim of thickened cuticle (seed-wart). Excessive prolongation of the papillæ without the surrounding rim forms the filiform, or thread-like, wart (*v. filiformis*), which is found in narrow lines along the free edges of the nails (*v. subunguinalis*), on the face, neck, eyelids, ears, and trunk, and may be single or multiple. The flat wart (*v. plana*) is a flattish wart with a slight elevation and broad and relatively smooth surface, retaining its outer layer of epidermis, and is met with chiefly in old people. *V. digitata* is a flat wart characterized by digitations springing from its centre or border. *V. acuminata* (fig-wart; moist wart; condyloma; cauliflower excrescence; venereal wart) is a warty growth occurring in parts especially subjected to maceration with sweat, venereal secretions, and mucous discharges, such as the genitals and anal regions of both sexes. They are flat, acuminate, whitish, reddish, pinkish, or flesh-colored, sessile or pedunculated masses of vegetations, commonly smeared with a thin, excessively offensive secretion. They are highly vascular, and may be single and small or as large as an orange, or they may be multiple. *V. congenita* is a wart appearing at or shortly after birth. *V. follicularis* is a wart-like accumulation around the mouth of the sebaceous follicles; it is composed of desiccated epithelium and sebaceous matter. *V. glabra* is a smooth wart. *Nævus verrucosus* is a form which is congenital, or may appear later, and is apt to be pigmented and become hairy; when these pigmented hairy growths cover a considerable area and lie over important cutaneous nerves, they often cause great disfigurement, and are called *papilloma neuroticum*. *V. necrogenica* (post-mortem wart; anatomical tubercle; warty tubercle; tuberculosis verru-

cosa cutis) is a warty excrescence found usually on the fingers of those who frequently handle the tissues of tuberculous subjects; it begins as a vesicular or pustular lesion rising from an engorged (congested) base, and may be purely local or give rise to general infection. *V. sebaceæ* is the form met with in persons of seborrhœic tendency and uncleanly habits. *V. senilis* (keratosis pigmentosa; keratosis senilis) is the flattened, pigmented wart of old people (see KERATOSIS SENILIS). *V. syphilitica* is a syphilitic condyloma. *V. venereæ* is a tubercular syphiloderm arranged in clusters.

TREATMENT.—The milder applications consist of the juice of the milk-weed (*Asclepias cornuti seu Syriaca*), the tincture of iodine, the solution of the perchloride of iron, moistened powder of chloride of ammonium; stronger applications are sublimate collodion (30 grains to the fluidrachm), glacial acetic acid, and fuming nitric (nitroso-nitric) acid. Excision, or curettage if the warts be soft, is the quickest method of removal; the hypodermic injection of cocaine will lessen or prevent the pain, and the application of fuming nitric acid to the stump or base will restrain the hæmorrhage and prevent return.

Instead of cutting or the use of caustics, an India-rubber finger-stall, if the warts are on the fingers, or an India-rubber bandage, if they are on the hands, should be used. The rubber exerts gentle pressure, while the wart is kept moist and macerated from retained perspiration. This method is always curative. Purdon (Dublin Jour. of Med. Science; Phila. Med. Jour., Mar. 3, 1900).

Warts cured by revaccination in a girl whose hands were covered with warts, there being ninety-four on one hand. No effect on the parts followed the vaccination until seven weeks later, when they began to disappear, leaving temporary white spots. Three months later the

hands were entirely clean. J. D. Staple (Lancet, Sept. 22, 1900).

Venereal warts may be washed well with bichloride or other antiseptic solution, and then dusted with iodoform, calomel, aristol, or euophen.

Cicatricial Tumors.—Under the name of cicatricial tumors we will mention two important conditions known as "Hypertrophied Scars" and "Keloid."

HYPERTROPHIED SCARS.—When a wound is completely healed, a cicatrix or scar occupies its place. Normally, two things are observed in a scar: its contraction and the gradual perfecting of its tissues. The principal changes by which the latter is accomplished are the removal of all the rudimental textures; the formation of elastic tissue; the improvement of fibrous or fibrocellular tissue of the new cuticle till they are almost, but not exactly, like those of natural formation; and the gradual loosening of the scar, so that it may move easily upon the subjacent tissues. The scar also becomes paler and more shining than the surrounding unaffected skin, for the numerous vessels, which the granulating surface possessed, gradually disappear, and are, for the most part, converted into fibrous cords. In some cases, especially after burns, the evolution of the scar does not follow this typical course, but, on account of the prolonged period of cicatrization consequent upon extensive loss of substance, an hypertrophy of a non-malignant character attacks the scar-tissue, sometimes resulting in the formation of masses of dense fibrous tissue varying in size and shape. These hypertrophied scars, on the completion of cicatrization or shortly afterward (from progressive contraction), may occur as nodular or warty excrescences, stellate, or in the form of bridles or reticular bands. This hypertrophic

process also occurs, late after cicatrization, in apparently normal smooth scars, giving rise to tumors of various shapes; the etiology in these cases is unknown, especially when the hypertrophy follows a linear incision. In these hypertrophied scars the papillary layer of the skin is wholly lacking, and the component bundles of fibrous tissue are disarranged. The blood-supply, at first abundant, lessens *pari passu* with the contraction of the scar-tissues.

Treatment.—The indications in this condition are best met by excising the hypertrophied scar and covering in the vacant space by a plastic operation. The resulting scar being greater than the original one, this method of treatment is not one of general application, and, moreover, the new cicatrix may also become the seat of hypertrophy.

KELOID.—Keloid (cheloid; kelis; Alibert's keloid; spurious keloid) is a new growth of connective-tissue formation having its seat or origin in scar-tissue and resulting in the formation of single or multiple tumors.

Symptoms.—It first appears as a pale-red nodule which slowly increases in size, assuming a more or less oval form, with irregular, well-defined, radiating projections. From its resemblance to a crab it derives its name. It may more rarely assume a linear form. The new growth is smooth, firm, elastic, pinkish, elevated, generally devoid of hair, usually painless, but sometimes tender when touched or subjected to pressure; and is occasionally the seat of the most intolerable itching, which no external application seems to relieve. The favorite location of this growth is over the sternum, but it may be situated on the mammæ, the neck, arms, and ears. In rare instances the growth may become inflamed and assume for awhile the ap-

pearance of malignancy, which appearance disappears usually with the spontaneous decline of the inflammatory action. The development of the growth may be slow or rapid, until a stationary period is reached, which varies in duration. Spontaneous disappearance of the growth not infrequently occurs. In some cases the growth becomes painful, in others a pigmentary deposit is noticed. This condition was first described by Alibert, and is known as spurious keloid to distinguish it from true keloid, which does not attack scars (Erichsen).

Diagnosis.—Alibert's keloid is differentiated from a simple cicatrix by its difference in consistence, outline, color, and elevation, and by its increase in size. Its points of difference from hypertrophied scars have been mentioned.

Etiology.—These new growths have their origin at the seat of some injury (sometimes very slight) to the skin, as the cicatrices of burns, floggings, cuts, or in the lobes of the ears when they have been pierced for the accommodation of earrings. They are most frequent in middle life and in the colored race.

Pathology.—The growth consists of dense fibrous tissue, which involves the corium and extends in the direction of the connective tissue about the blood-vessels.

Prognosis.—The prognosis is not generally very favorable, although the growths may sometimes disappear spontaneously. The stationary period may extend over years or during life. Occasionally, after a stationary period of variable duration, an increase in size takes place.

Treatment.—The treatment of these new growths is not very satisfactory. The application of anodyne liniments or hypodermic injections of morphine will generally relieve pain when present.

The administration of large doses of liquor potassæ will often relieve the pruritus. Removal by knife or caustics should not be attempted while the growth is increasing. Fused caustic potash is recommended as best, if any caustic is used. Multiple electrolytic puncture and repeated scarification, making numerous parallel linear cuts crossed at various angles by other parallel linear cuts, have been suggested with the idea of replacing the diseased scar by a healthy one.

The hypodermic administration of thiosinamin produces an immediate disintegration and elimination of white blood-cells. This is followed by leucocytosis, persisting for forty-eight hours. It is in this pathological power that the explanation of its value in keloid is found, acting, as it does, in increasing cellular activity in the fixed connective-tissue cells throughout the body. An hypodermic solution made by dissolving 10 parts of thiosinamin in 100 parts of a sterilized mixture of water and glycerin are indicated as a full dose into the glutei or triceps muscles every three days. Sinclair Tousey (N. Y. Med. Jour., Nov. 6, '97).

Malignant Degeneration of Scars.—The cicatrix of a burn or other extensive scar may undergo malignant degeneration many years after its formation. Erichsen removed a large cancrioid growth from the cicatrix of a burn, on the forearm of a woman, seventy years after the receipt of the injury, which happened in childhood.

C. SUMNER WITHERSTINE,
Philadelphia.

SODIUM.—Sodium, or natrium, is a light, soft, ductile, malleable metal, of silver-white lustre, when freshly cut, and of dull-gray color when oxidized by air. On account of its great affinity for oxygen, it must be kept immersed in a liquid

free from oxygen, such as naphtha or benzene.

Sodium is a very abundant element, and very widely diffused. It occurs naturally, in large quantities, as chloride, in sea-water, rock-salt, salt springs, and many mineral waters; more rarely as carbonate, borate, and sulphate, in solution or in the solid state, and as silicate in many minerals.

Soda (sodium hydroxide; caustic soda; sodium hydrate) occurs in white, deliquescent plates or sticks. It has an acrid, caustic taste, and is soluble in 1.7 parts of cold water and 0.8 part of boiling water and in alcohol. The official solution of soda (soda-lye) contains 5 per cent. of caustic soda, and occurs as a clear, colorless liquid, of strong alkaline reaction, incompatible with fats, organic matter, and ammonium salts. The official solution of chlorinated soda (Labarraque's solution) consists of several chlorine compounds of sodium in aqueous solution; it should contain 2.6 per cent., or more, of available chlorine. It occurs as a pale-greenish liquid, having a chlorine odor and a disagreeable alkaline taste.

Sodium acetate occurs in colorless, monoclinic crystals, which effloresce upon exposure. It is soluble in 1.4 parts of cold and 0.5 part of boiling water, in 30 parts of cold and in 2 parts of boiling alcohol.

Sodium bicarbonate (acid sodium carbonate; baking-soda) occurs as a white, opaque powder, having a cooling, mildly-alkaline taste. It is soluble in 11.3 parts of water. This salt should not be given as an acid antidote, as it evolves large quantities of carbonic-acid gas. The official mixture of rhubarb and soda contains: fluid extract of rhubarb, 15 parts; fluid extract of ipecac, 3 parts; sodium bicarbonate, 35 parts; glycerin, 350

parts; spirit of peppermint, 35 parts; water, sufficient to make 1000 parts.

Sodium bisulphite (leucogen) occurs in opaque prisms or in granular powder, having a faint, sulphurous odor and a disagreeable taste. It is soluble in 4 parts of cold and 2 parts of boiling water, and in 72 parts of alcohol. It is incompatible with acids.

Sodium carbonate (washing soda, alkaline carbonate) occurs in large, monoclinic crystals, having a strong alkaline taste, which effloresce upon exposure and should be 98.9 per cent. pure. It is soluble in 1.6 parts of cold and 0.2 part of boiling water, and in 1 part of glycerin.

Sodium chlorate occurs in colorless, odorless, crystals having a cooling, saline taste. It is soluble in 1.1 parts of cold and 0.5 part of boiling water, in 5 parts of glycerin, and in 100 parts of alcohol. This salt must not be triturated with sulphur or phosphorus, or any combustible substance, as severe explosion would result.

Sodium chloride (table-, sea-, or common salt) occurs in colorless, transparent crystals or in white crystalline powder having a pure saline taste. It is soluble in 2.8 parts of cold and in 2.5 parts of boiling water.

Sodium hyposulphite (sodium thio-sulphate) occurs in white, transparent, monoclinic prisms, having a cooling taste, with bitter after-taste. It is soluble in 0.65 part of water, but insoluble in alcohol. It is incompatible with iodine, acids, etc. It must be kept well stoppered.

Sodium nitrate (cubic nitre, or saltpeter; Chili saltpeter) occurs in colorless, transparent, rhombohedral crystals, having a saline, slightly-bitter taste. It is soluble in 1.3 parts of water and in 100 parts of alcohol. It is less active than saltpeter (potassium nitrate).

Sodium sulphate (Glauber's salt) occurs in colorless, monoclinic prisms or in granular crystals, having a bitter, saline taste. It is soluble in 2.8 parts of water and in glycerin. Keep well stoppered.

Sodium sulphite occurs in colorless, monoclinic prisms, having a saline, sulphurous taste. It is soluble in 4 parts of cold and 0.9 part of boiling water and sparingly in alcohol. Keep well stoppered and cool.

Sodium silicate (soluble glass) occurs in white to grayish-white hard crystals and in flat pieces. It is soluble in water. The solution alone is official, and occurs as a yellowish or pale-greenish-yellow viscid liquid, having a sharp alkaline and saline taste. It is incompatible with acids. Keep rubber-stoppered.

Preparations and Doses.—Soda, U. S. P. (sodium hydrate; sodium hydroxide; caustic soda).

Liquor sodæ (U. S. P.), 5 to 20 minims.

Liquor sodæ chloratæ (U. S. P.), $\frac{1}{2}$ to 1 drachm.

Sodii acetat (U. S. P.), 10 to 40 grains.

Sodii arsenas (U. S. P.), $\frac{1}{24}$ to $\frac{1}{8}$ grain. (See ARSENIC.)

Liquor sodii arsenatis, U. S. P. (s. arsenas, 1 per cent.), 3 to 10 minims. (See ARSENIC.)

Sodii benzoas (U. S. P.), 10 to 60 grains. (See BENZOIC ACID.)

Sodii bicarbonas (U. S. P.), 10 to 60 grains.

Mistura rhei et sodæ (U. S. P.), $\frac{1}{2}$ to 2 ounces.

Pulvis effervescens compositus, U. S. P. (Seidlitz powder. See POTASSIUM), 1 powder.

Trochisci sodii bicarbonatis, U. S. P. (3 grains), 1 to 6 troches.

Sodii bisulphis (U. S. P.), 10 to 30 grains.

Sodii boras, U. S. P. (borax), 5 to 30 grains. (See BORACIC ACID.)

Sodii bromidum (U. S. P.), 10 to 60 grains. (See BROMINE.)

Sodii carbonas (U. S. P.), 5 to 20 grains.

Sodii carbonas exsiccatus (U. S. P.), 3 to 15 grains.

Sodii chloras (U. S. P.), 3 to 15 grains.

Sodii chloridum (U. S. P.), 10 to 60 grains.

Sodii hypophosphis (U. S. P.), 5 to 20 grains. (See PHOSPHORUS.)

Syrupus hypophosphitum (U. S. P.), 1 to 2 drachms. (See PHOSPHORUS.)

Sodii hyposulphis (U. S. P.), 5 to 24 grains.

Sodii iodidum (U. S. P.), 5 to 60 grains. (See IODINE.)

Sodii nitras (U. S. P.), 8 to 40 grains.

Sodii nitris (U. S. P.), 1 to 3 grains. (See NITRITES.)

Spiritus ætheris nitrosi (U. S. P.), $\frac{1}{4}$ to 1 drachm. (See NITRITES.)

Sodii phosphas, U. S. P. (sodium orthophosphate), 1 to 8 drachms. (See PHOSPHORUS.)

Sodii pyrophosphas (U. S. P.), 5 to 40 grains. (See PHOSPHORUS.)

Sodii salicylas (U. S. P.), 8 to 60 grains. (See SALICYLIC ACID.)

Sodii sulphas (U. S. P.), 1 to 8 drachms.

Sodii sulphis (U. S. P.), 10 to 60 grains.

Sodii sulphocarbolas, U. S. P. (sodium paraphenolsulphonate), 8 to 30 grains. (See PHENIC ACID.)

Liquor sodii silicatis, U. S. P. (liquid glass).

Potassii et sodii tartras, U. S. P. (Rochelle salt), 1 to 4 drachms. (See POTASSIUM.)

Pasta Londoniensis (London paste or caustic,—equal parts of caustic soda and

unslaked lime), used externally as a caustic.

Physiological Action.—The general action of the alkalies upon the system has already been noted in the article upon potassium (*q. v.*). Sodium and its salts seem to have very little influence upon the higher animals, differing, in this respect, from potassium. The immediate effect of the sodium salts upon the blood is very slight. Podocæpow asserts that one part dissolved in twelve parts of blood does not affect either the physical characters of the red blood-corpuscles or the intensity of the ozone reaction. The effect of the continuous exhibition for a few days of large amounts of salt upon the human organism has been investigated by Münch (*Archiv Vereins Gemeinschaft Arbeiten*, B. 6, p. 369, '63), and found to be very feeble. At first there was a slight diminution of excretion, and a corresponding gain of the body in weight; but after a time the excretions increased and the weight of the body decreased. The variations in excretion affected chiefly the urine, but sometimes the perspiration and the faces were also influenced. The urine was rendered alkaline, but its solid ingredients were scarcely at all affected.

Although a certain amount of the sodium salts is a necessary food for the higher animals, yet it is very doubtful whether an habitual excess of them has any decided effect upon nutrition; it must be conceded as established that the sodium salts do not increase tissue-waste (H. C. Wood).

It appears to be proved, clinically, that the alkaline salts of sodium given one or two hours before meals in full doses excite gastric secretion and are of decided value in the treatment of chronic hepatic torpor, catarrhal jaundice, and especially of gall-stones or other affections asso-

ciated with excessive viscosity of the biliary secretions (H. C. Wood). From the experiments of W. Rutherford (*Trans. Royal Society of Edinburgh*, xxix) he concluded that sodium sulphate, sodium phosphate, and Rochelle salt very greatly increased biliary secretion, at the same time purging, while sodium chloride had some, but not a powerful, effect upon the liver. The sulphite, bisulphite, hyposulphite, chlorate, chloride, and the solution of chlorinated 'soda have antiseptic properties. Soda unites with the fats and saponifies them.

Even in large doses the soda salts exert no action upon the heart, cause no diminution in the temperature, and produce no apparent effect upon the brain, spinal cord, nerves, or muscles (Ringer).

The acetate is diuretic in its action, but less so than the potassium salt, and is seldom, if ever, used. H. C. Wood claims that it does not possess the same remedial powers as the potassium salt.

Sodium nitrate, although official, is seldom used in medicine.

The sulphite exposed to the air rapidly absorbs oxygen and becomes the sulphate. The hyposulphite is more stable. In the stomach the salts are, in part, decomposed by the gastric juice, and sulphurous acid is given off; in part they are converted into sulphates, and are eliminated partly by the intestinal canal, but chiefly by the kidneys, as sulphates. Bartholow, repeating the experiments of Polli, of Milan, who recommends the administration of these remedies in zymotic diseases, has demonstrated these facts.

Poisoning by Sodium and its Salts.—Soda, like potassa and ammonia, is seldom taken for the purpose of suicide. (See POTASSIUM, POISONING BY.) The soda salts are far less poisonous than the potash salts, and, as we have noted, do not produce, like the latter, a direct

poisonous action upon the heart. Soda salts, in two or three times the quantity which would prove fatal in the case of the potash salts, produce no effect upon the system, except a passing weakness (Ringer).

Caustic soda is, however, a powerful corrosive poison; its solution is an acrid irritant poison in overdose. The carbonate and even the chloride are poisonous if taken in sufficient quantities. The solution of chlorinated soda is a powerful irritant, capable of producing severe inflammation of the skin or toxic gastro-enteritis.

The symptoms and treatment of poisoning by soda are similar to those of poisoning by the other alkalies (potash, lime, ammonia). Death follows, in fatal cases, from shock or gastro-enteritis. The chemical antidotes, vinegar, lemon-juice, or other weak acids and oils may be administered, after large draughts of water have been given to dilute the poison. Further treatment will be suggested by the symptoms.

Therapeutics. — **GASTRO-INTESTINAL DISORDERS.**—Soda and its alkaline salts are used extensively in disorders of the alimentary canal. Given in small doses before meals they increase the acid secretions of the stomach; in somewhat larger doses, given from a half-hour to one and a half-hours after meals, they neutralize any excess of acid in the stomach and favor intestinal digestion.

In gastric fermentation and sick headache arising from it, the bicarbonate may be used as an antacid; combined with calomel it adds to its efficiency in increasing the biliary flow, as it liquefies and thins the bile. In acidity of the stomach and in the vomiting attendant upon acute inflammatory diseases and the exanthemata, the bicarbonate is useful in the form of effervescing powder

(sodium bicarbonate, 30 grains; tartaric acid, 10 grains; each dissolved separately in half a glass of water, the one solution added to the other and swallowed during effervescence). (For the use of the sulphocarbonates in this condition see PHENIC ACID.)

In the treatment of children where an antacid is required and constipation is present, the bicarbonate is better than lime-water.

In yeasty vomiting, especially when *sarcinae* are present in the vomited matters, the sulphite is often curable in doses of from 5 to 20 grains. The vomiting due to acid fermentation of starches and sugars is relieved by the sulphite in doses of from 20 to 60 grains; sulphurous acid, in doses of from 5 to 60 minims well diluted, is, however, better.

In gastric indigestion the use of the chloride is followed by good results. The chloride combines with lactic acid in the stomach, forming lactate of sodium and liberating nascent hydrochloric acid, which acts not only by aiding digestion, but by increasing the production of pepsin from the pepsinogen of the gastric tubules. The usual dose for this purpose is from 10 to 20 grains.

In acid dyspepsia relief will follow the use of the bicarbonate taken a half-hour to an hour after meals. The following mixture is a good one: Sodium bicarbonate, 3 $\frac{1}{2}$ drachms; tinctures of ginger and of capsicum, of each, 1 drachm; tincture of *nux vomica*, 3 $\frac{1}{2}$ drachms; compound tincture of gentian, sufficient to make 5 ounces; of this a dessertspoonful may be taken, an hour after meals.

In catarrhal jaundice the bicarbonate combined with rhubarb is especially useful; the official mixture of rhubarb and soda may be given.

In chronic hepatic affections good results have followed the use of the solu-

tion of chlorinated soda, in doses of from $\frac{1}{2}$ to 2 drachms, diluted in from 4 to 8 ounces of water.

In constipation the sulphate is rarely used in human beings, though largely in veterinary practice, as it is one of the most irritant of the saline purges, producing large, watery stools with considerable griping. The purgative dose is from $\frac{1}{2}$ to 1 ounce. Its use is contra-indicated if any intestinal inflammation be present. It is one of the constituents of Carlsbad, Hunyadi, and similar waters.

In the impending collapse of cholera, and in that following severe hæmorrhages as well, intravenous injections of the chloride in solution (93 grains to 1 quart of sterilized water at 100° F.: "normal salt solution") have been used as a prophylactic and restorative agent.

In intestinal infections of children at the breast a 7.5-per-mille solution injected under the skin of the abdomen, in quantities not exceeding in all 30 cubic centimetres in the twenty-four hours, apparently stimulated the entire system by increasing the blood-pressure and raising the temperature. The treatment seems to be indicated in infectious enteritis with hypothermy, and in chronic cases with loss of strength and low temperature, but it has no effect on the diarrhœa, general nutrition, or any of the phenomena other than those of collapse. Barbier (*Sem. Méd.*, p. 488, '96).

In a synopsis of ten weeks' service on the Boston Floating Hospital the writer refers to the fact that, in addition to the use of stimulants in children that were very ill, normal salt solution under the skin (*i.e.*, hypodermoclysis) was found to be "of much value." He states that the sterile apparatus was always ready and warm, and was in daily, almost hourly, use. Every five or six hours and in amounts varying from 1 to 5 ounces (30 to 150 grammes), given under the skin of chest, back, or abdomen, was the rule. No harm resulted in any case, save two or three small abscesses, the

cause for which was readily found in imperfect sterilization of the needle. It causes the baby little or no pain, and certainly seems to act as a powerful restorative. It can be readily given by a nurse, who must, however, give her entire attention to the matter.

Enteroclysis or irrigation of the lower bowel was performed nearly seven hundred times. It was much more commonly used in the early portion of the season. This seems to be due to a growing feeling on the part of the physicians that cases for this treatment should be carefully selected. There were no bad effects. Two quarts of solution were commonly employed, with a pressure of eighteen inches, through a flexible rubber catheter, Nos. 21 to 23, American scale, inserted gently twelve or fourteen inches. The usual solution was normal salt solution, sterile water, or solution of soda bicarbonate from 3 drachms (12 grammes) to the pint ($\frac{1}{2}$ litre) to 1 drachm (4 grammes) to 2 pints (1 litre). R. W. Hastings (*Boston Med. and Surg. Jour.*, Jan. 15, 1903).

In cancer of the stomach the use of the chlorate has, in some cases, been followed by the happiest results. The initial dose is 2 drachms daily, in divided doses; this dose is gradually increased until 4 drachms are taken daily. If albuminuria be present or be developed during the course of medication, this treatment is contra-indicated. (Brisaud.)

In mercurial stomatitis, aphthæ, mucous patches, ulcers of the tonsils, the sulphite in solution (1 to 8) may be applied by a mop or in the form of spray.

Seat-worms (oxyuria) may be dislodged from the rectum by injection of a solution of the chloride; the injections remove the worms and relieve the intense itching.

In dysentery the use of the nitrate, in drachm doses, freely diluted, every three hours, has been recommended.

CUTANEOUS DISORDERS. — In acute eczema, when there is much serous dis-

charge, no application is more efficient than the following: Sodium carbonate, $\frac{1}{2}$ drachm; water, 1 pint; cover the eruption with lint soaked in this solution, which may be made stronger in old cases where the skin is much thickened (Bartholow). When the weeping has ceased and mere desquamation remains, the alkali ceases to be of use (Ringer).

The pruritus of eczema, lichen, urticaria, dermatitis, burns, and frost-bite may be relieved by applications of the following: Sodium bicarbonate, 3 drachms; glycerin and distilled extract of witch-hazel, of each, 3 ounces. The itching of urticaria and lichen will often yield to a solution of carbonate (1 to 96); applied with a sponge it often gives great comfort and ease.

Poison-ivy eruption and other forms of pruritus may be soothed by the hyposulphite in solution (1 to 16), the solution of the bicarbonate, or by the solution of chlorinated soda diluted (1 to 32).

In parasitic skin diseases, especially those due to the trichophyton fungus, as pityriasis versicolor, the hyposulphite (1 to 8) in solution or ointment is valuable. Startin recommends the following: Sodium hyposulphite, 3 ounces; dilute sulphurous acid, $\frac{1}{2}$ ounce; water, sufficient to make 1 pint. In tinea versicolor and pruritus vulvæ Fox finds the following useful: Sodium hyposulphite, 4 drachms; glycerin, 2 drachms; water, sufficient to make 6 ounces.

In scabies the hyposulphite has been used successfully. After the morning bath apply the hyposulphite in solution (1 to 1) to the affected part and allow it to dry on the skin; at night bathe with the following lotion, which may be diluted if found too strong: Dilute hydrochloric acid, 4 ounces; distilled water, 6 ounces. (Ohmann-Dumesnil.)

For the removal of freckles, sunburn, and tan, Trousseau recommends the use of the following lotion: Sodium chloride, 2 drachms; potassium carbonate, 3 drachms; rose-water, 8 ounces; orange-flower water, 2 ounces. The inflammation of sunburn may be subdued by applications of the bicarbonate in solution.

In hyperidrosis of the feet and the axillæ a solution of the carbonate freely applied locally will remove the fœtor and diminish the secretion of sweat.

In burns and scalds the bicarbonate in powder or in solution will relieve the pain and soreness very promptly.

The carbonate is used externally, when it is desirable to soften or remove scaly or scabby accumulations upon the skin, as in certain forms of eczema, plica polonica, etc.

GENITO-URINARY DISORDERS.—Irritation of the urinary organs due to an excess of acid is allayed by the bicarbonate, in doses of 10 to 20 grains, given, in a glass of water, every four hours. Huchard recommended the daily administration of 2 to 10 drachms of the bicarbonate in the hyperacidity of the stomach accompanying diabetes; he believes that such use of the bicarbonate averted threatened coma in a diabetic patient under his care.

In cystitis a 1-per-cent. solution of the bicarbonate may be used to wash out the bladder, when an acid condition of that viscus exists.

Gonorrhœa is relieved by injections of a 1-per-cent. solution of the bicarbonate.

In malarial hæmaturia the hyposulphite is given with advantage in doses of from 10 to 30 grains, every four hours. Its mode of action is unknown.

Diabetes, when arising from disordered digestion in obese subjects, is benefited by soda and its alkaline salts; the amount

of sugar excreted is, however, not lessened.

In uræmia, dyspnœa, and eclampsia, the intravenous injection of normal salt solution (93 grains to 1 quart) has been followed by excellent results; previous bleeding enhances the value of this method of treatment.

LARYNGOLOGICAL AND RESPIRATORY DISORDERS.—In asthma the use of the nitrate in 3- or 4-grain doses has been highly commended.

In pulmonary tuberculosis, when the bronchial secretion was scanty and viscid, E. Maragliano obtained good results from the use of the following, as a spray: Sodium bicarbonate, 15 to 30 grains; muriate of morphine, $\frac{3}{4}$ grain; distilled water, $3\frac{1}{2}$ ounces.

In pulmonary hæmorrhage the administration of dry salt is a popular remedy.

In capillary and other hæmorrhages Reverdin claims that 2-grain doses of the sulphate every hour are of great value. It must be given by mouth or intravenously, not hypodermically, as it is then useless.

Sulphate of soda as a styptic is especially useful in cases of epistaxis, of metrorrhagia, of capillary hæmoptysis, and in the hæmorrhagic diathesis. It seems to act like calcium chloride, by increasing the rapidity with which the blood clots, and its styptic action is equally well marked, whether it be given by the mouth or by intravenous injection. Its administration hypodermically into the subcutaneous tissue does not give the same result. The dose is $1\frac{1}{2}$ grains every hour until the bleeding stops. Reverdin (*Revue Méd. de la Suisse Rom.*, Jan. 20, '97).

In severe hæmorrhage with threatened collapse, the use of normal salt solution by intravenous injection is indicated.

In acute tonsillitis, catarrhal conditions, bronchitis, etc., the bicarbonate in solution may be combined with ham-

amelis, belladonna, or other remedial agent.

The early stages of coryza in an adult of medium size and weight may be successfully treated by 20 to 30 grains of the bicarbonate of soda given in 2 or 3 ounces of water, every half-hour, for three doses, and a fourth dose at the expiration of an hour from the last one. Two to four hours are then allowed to elapse, that the effect may be seen, and the four doses are repeated if there seems to be necessity, as is frequently the case. After waiting two to four hours more the same course may be taken again. To be promptly effective it should be begun with the earliest indications of coryza and sneezing, when it rarely fails to break up the cold, even in persons much inclined to "colds." Bulkley (*Medical Record*, Jan. 18, '96).

In affections of the throat and fauces the chlorate is better and safer than the potash salt. It has also been recommended in epithelioma of the mucous membrane of these organs.

All kinds of tonsillitis treated with gargles of sodium salicylate: $1\frac{1}{2}$ to 2 drachms (6 to 8 grammes) in 5 to 6 ounces (150 to 180 cubic centimetres) of peppermint-water. The average duration of the disease under this treatment in personal cases was four days: the temperature soon declined, the pain in the throat and the difficulty in deglutition disappeared rapidly, and in no case did an abscess form. Chevallier (*Klin. therap. Wochen.*, No. 2, 1901).

In malignant sore throat and diphtheria the solution of chlorinated soda ($\frac{1}{2}$ to 2 drachms in water, 4 to 8 ounces) has been used as a gargle. The sulphite in solution (1 to 8) is an excellent remedy employed as a gargle, spray, or local application; the same salt is also used internally in combination with sulphur and calomel.

Solutions of the bicarbonate are extensively used in catarrhal conditions to soften and remove dried secretions and thickened mucus. Dobell's solution (so-

dium bicarbonate and borax, of each, 2 drachms; carbolic acid, 24 grains; glycerin, 14 drachms; water, 1 pint) is largely used for this purpose. E. Pynchon advises the following as better: Sodium bicarbonate and borax, of each, 2 ounces; listerin, 8 ounces; glycerin, 1 $\frac{1}{2}$ pints; of this add 1 ounce to 1 pint of water. This is a bland, pleasant, alkaline solution having about the same specific gravity as the blood (1.015).

GYNÆCOLOGICAL AND PUERPERAL DISORDERS.—Leucorrhœa, when dependent upon an increased secretion of the cervical glands, yields to injections of a weak solution (1 to 96) of the bicarbonate. This secretion is strongly alkaline, and is checked on the general principle that alkalies check alkaline secretions.

In the palliative treatment of cancer of the uterus, Boucher, of Rouen (Ther. Woch., Aug. 16, '96), prescribes the following: Sodium chlorate, 2 parts; syrup of orange-flowers, 3 parts; distilled water, 10 parts; of this two "spoonfuls" are to be taken during the day at first and then gradually increased to 8 "spoonfuls." The following powder is applied on intracervical tampons: Sodium chlorate and bismuth nitrate, of each, 2 parts; iodoform, 1 part. In addition the vagina is irrigated daily with a solution of 150 grains of sodium chlorate in a quart of boiled water. This method of treatment is claimed to prolong life, in many cases, for a year, and make it reasonably tolerable.

In puerperal metritis the solution of chlorinated soda (1 part to 10 or 12 of water) has been used as an antiseptic injection. In the same strength it may be used as a vaginal douche when the lochial discharge becomes foetid. It is also a useful injection in simple and gonorrhœal vaginitis.

In threatened collapse from post-partum hæmorrhage or hæmorrhage from placenta prævia, intravenous injections and intraperitoneal infusion of normal salt solution must not be forgotten.

LITHÆMIC DISORDERS.—Rheumatism is amenable to the action of the alkalies. The bicarbonate has been largely used and is of great service in allaying the pain and soreness of the joints when given internally in doses of from 15 to 30 grains every four hours. It is also used in solution as a lotion, applied around the joints on lint or cloths. The nitrate in solution (1 to 3) has been used externally in like manner. The acetate has been given in acute rheumatism and gout, but its value is much less than the potash salt.

The use of rectal injections of large doses of sodium salicylate is recommended in diverse, painful, articular lesions, particularly of rheumatic origin. From 8 even up to 12 grammes of the salicylate may be used per day, in two injections of a cupful of water each, to which are added, if desired, several drops of laudanum. The quantity of the salicylate is reduced by 1 gramme every other day, according to the results obtained, and when 7 grammes are being given, only one injection is made daily, in the evening. Should the pains recur, the doses are again increased. Harlet (Sem. Méd., vol. xviii, p. 114).

SURGICAL DISORDERS.—In fractures and sprains the solution of the silicate is a valuable dressing, as it rapidly becomes hard and immovable when painted over the bandages and thus forms an immovable splint which is cleaner than plaster of Paris and equally effective.

Morbid growths, warts, etc., may be removed by applications of caustic soda or of London paste.

Foul ulcers, sinuses, etc., may be cleansed by the solution of chlorinated

soda diluted ($1\frac{1}{2}$ to 2 drachms in 4 to 8 ounces of water).

SALINE SOLUTION.—As practiced at the Johns Hopkins, according to J. G. Clark (Canadian Practitioner, Aug., '97), graduated, glass infusion-jars of one thousand cubic centimetres' capacity, made according to Dr. Kelly's designs, are used as reservoirs for the solution. The bottles are connected by five feet of rubber tubing to a long, slender infusion-needle, the calibre of which is two millimetres in diameter, similar to an aspirating needle. The entire apparatus is sterilized and kept in a sterile envelope, and is available for use at any moment. Before giving the infusion the breast, in the case of women, is carefully disinfected, especially well in its dependent area. It is then grasped with one hand and lifted well up from the thorax, while the needle, with the fluid flowing from it, is quietly thrust beneath the gland. Usually, simple elevation of the reservoir is sufficient to force the fluid into the loose cellular tissue, and the breast quickly begins to distend until even a flabby and atrophied organ will reach the size of the puerperal breast. The needle is quickly withdrawn and the puncture is closed with rubber tissue or adhesive plaster. If the fluid does not flow by its own pressure it can be effectually forced in by stuffing the tube. The hands and tube are well anointed with vaselin; the upper portion of the tube is tightly pinched, and from this point down the tube is gently stripped between the fingers of the other hand, driving the column of fluid ahead into the tissue. The lower portion is then pinched between the fingers and the upper is released, allowing the water to fill the collapsed intermediary portion of the tube. Seven hundred cubic

centimetres ($1\frac{1}{2}$ pints) of solution may be injected under each breast. If care is observed in the cleansing of the breasts and the injection of the fluid, no untoward results will follow, which certainly cannot be said of the infusion into the radial artery or vein.

Its use in abdominal operations has become quite general. Clark states that the more extensive one's experience becomes in the use of normal salt solution, as a stimulant in these operations, the more convincing is the evidence of the benefits to be obtained by its use. During the past four years he has made it a practice to leave at least one litre in the peritoneal cavity, after even the simplest operations. It increases the volume of the blood, lessens its specific gravity, stimulates the cardiac ganglia, and accelerates the circulation. The skin, kidneys, and intestines are stimulated, and all the organs of the body functionate better under its influence. The number of red blood-corpuscles is distinctly increased. Its special use in abdominal cases is to prevent shock, to lessen the effects of hæmorrhage, and to decrease the virulence of infection. Next to the Trendelenburg posture, the author regards the introduction of the normal salt solution as one of the greatest benefits which have been conferred upon modern surgery in the last five years. Its most marked advantages are claimed to be a lessening of the thirst and an increase in the urinary excretion. Drainage regarded as a problematic benefit, because of the rapidity with which absorption takes place by the lymphatics and peritoneum. In these cases an infusion of large quantities of normal salt solution combined with the elevated dorsal posture is recommended. In moribund patients Clark has seen a marvelous stimulation

from this treatment, which safely tided them over a critical period. Submammary infusions are quite as beneficial; they act almost as rapidly as intravenous transfusions, and are devoid of some of the complications which attend the latter.

The application of this therapeutic measure is defined under the headings of the various diseases in which it is indicated.

A region that seems especially advantageous for hypodermoclysis is the space between the highest part of the crest of the ilium and the lower border of the ribs, which, for convenience, may be denominated the ilio-lumbar region. It does not interfere with the dorsal posture, nor do movements of the limbs or neck, or thoracic or abdominal respiration, cause discomfort. It would seem to be a point of very little motion. The decinormal saline solution should be employed, the formula, roughly speaking, being in the proportion of 1 drachm of salt to 1 pint of water. The solution should be sterile, also the needle, and the region to be punctured should be sterilized. The fountain-syringe or the Davidson syringe should also be sterilized. The specific action of small quantities of normal saline solution on renal secretion has been clearly demonstrated, and 2 to 6 ounces injected frequently—every three or four hours—is advocated as a better diuretic and causing less strain on the kidneys than 1 pint given three or four times daily.

In any clinical condition in which the general circulation is markedly impaired, hypodermoclysis is a slower method than under other conditions; nevertheless it is of great value, for, even so, absorption can be hastened by the addition of enteroclysis (at 110° to 120° F.) while performing the hypodermoclysis, or even by a simple hot saline enema. Enteroclysis (continuous) at 110° to 120° F. while giving the subcutaneous saline injection is advocated. Gentle peripheral massage during the injection also hastens absorption.

A single attachment converting an aspirating or a hypodermic needle into a needle for hypodermoclysis consists merely of a small fitting, with a screw thread of a size suitable to screw into the average aspirating or hypodermic needle. It has an enlargement adapted to fit snugly the rubber tube of a fountain-syringe or Davidson's syringe. The attachment, being metal, can be boiled. Hypodermoclysis may be performed with successful results, even with the finest hypodermic needle and a fountain-syringe. In such a case the fountain-syringe had better be elevated six or seven feet, as the force exerted by the fine stream is slight, and extra back-pressure is desirable. The fluid should flow freely from the needle as the puncture is being made. If the flow ceases, on account of the resistance to the small stream, pushing the needle in and then withdrawing it slightly or rotating it will generally start it again.

There is a great loss of heat when the fine needle is employed, and the fluid in the fountain-syringe should then be about as hot as the hand can bear comfortably, or about 110° F. If the larger aspirating needle is used, the fluid can be at 105° F., as even here there is considerable loss of heat.

The pain of the puncture may be avoided by freezing with ethyl-chloride. Peripheral massage hastens absorption. R. C. Kemp (Med. Record, Apr. 14, 1909).

In hæmorrhage and collapse rectal injections of warm saline solutions recommended. Half a gallon of the solution, containing 1 ounce of table-salt to the gallon of water, at 110° to 115° F., may be injected into the intestine and retained by pressure on the anus. The solution is absorbed rapidly in the sigmoid flexure and colon, and the pulse and color promptly return. The rectal method takes less time than hypodermoclysis or transfusion; it is less painful and less dangerous. A fountain-syringe is alone needed and in its absence a common hand-syringe may be employed. T. B. Greenley (Jour. Amer. Med. Assoc., Feb. 9, 1901).

By *transfusion* is meant the introduc-

tion into the vessels of the body of fluid material, especially of blood taken from another body, also the act of causing a fluid to pass through the skin into the body; *infusion*, a pouring into, as distinguished from transfusion, the gentle injection of any other liquid than blood into a vein or subcutaneous tissue; and, by *autotransfusion*, the application of elastic or muslin bandages to the extremities for the purpose of forcing the blood toward the vascular and nervous centres, emptying the vessels of the extremities into the vessels of the abdomen, lungs, and brain, and keeping it there until the crisis has passed. (G. W. Wagoner.)

Autotransfusion can only be considered as a good transient expedient, applicable until saline injections can be used, or to supplement the latter. For all practical purposes the infusion of saline solution alone deserves consideration as a therapeutic agent. It is indicated in the following conditions:—

Hæmorrhage, from whatever cause, and especially the obstetrical hæmorrhages.

Shock, with or without loss of blood.

Collapse, occurring in the course of any disease, particularly cholera, cholera infantum, typhoid fever, and especially in the collapse following severe operations.

Puerperal infection, in which the salt solution is given to increase the power of the tissues and blood to resist the action of the microbes, destroy them and assist Nature in throwing off their effects. It should be given hypodermically in 2-ounce doses, twice daily for some days. Good results have followed such a practice, and it may be that other infectious diseases would be benefited by similar treatment.

Epilepsy and puerperal eclampsia, especially after a preliminary bleeding.

Uræmic convulsions, both after bleeding and as a diluent of the blood, and to favor the elimination of urea by the kidneys.

In poisoning by coal-gas or by narcotics it is a powerful aid to elimination.

Anæmia, in the different forms, to be followed by appropriate food and medication.

In all cases the treatment must be considered as the most helpful expedient that can be used to bridge over the gravest emergencies, and thus gain sufficient time in which the slower-acting, but more permanently useful, remedies may exert their curative effects. G. W. Wagoner (Amer. Medicine, May 11, 1901).

Salt solution is employed by the writer in all diseased conditions associated with either hæmorrhage or intense toxæmia. In hæmorrhage it replaces the fluid lost to the tissues and refills the blood-vessels, thereby giving the heart something on which to work. It stimulates the cardiac ganglia; sustains the nutrition of the heart itself, rendering it possible for the remaining blood to be propelled to the vital centres; and sustains life temporarily until new blood can be formed. It raises the temperature to normal and relieves collapse. In toxic conditions it excites diaphoresis and diuresis, lowers the specific gravity of the urine, increases phagocytosis, dilutes the poisons circulating in the blood-stream, and, by a process of cell-lavage, removes the toxin from the paralyzed cell, allowing it to resume its normal function. H. F. Thompson (Medical News, April 25, 1903).

SPASMODIC LARYNGITIS. See RESPIRATORY ORGANS, NEUROSES OF.

SPASMS AND CONVULSIONS IN CHILDREN.

Tetany.—Tetany is a motor neurosis called by some authorities a disease, but is more generally described as a mere disorder based upon several pathological factors which are more or less constant. It is probably of toxic origin and bears close etiological relationship to rickets;

being based upon similar causative factors and sharing some of the symptom-phases of that disease. It is far from common, yet cannot be considered rare; and is much more frequently recognized of late years since its entity is better known and clearly described. Tetany is manifested by characteristic attitudes of the hands and certain intermittent tonic cramps of the muscles of the arms and legs, by an excessive electrical irritability, and by periods of latency, during which the cramps can be induced.

Symptoms.—The symptoms of tetany are to be divided into those of the attack and those of the period of latency. The onset of the paroxysms may be preceded by sensory phenomena, but is often sudden and without warning. The sensations are usually vague tingling pains in the forearms and legs, followed soon by a tonic spasm or a stiffness in the muscles. This spasm is most marked in the upper extremities, giving rise to such a pronounced rigidity that it is almost impossible to overcome the resistance by active effort on the part of another. Occasionally, the adductors of the thighs and arms are involved, causing the arms and legs to be drawn together; more rarely the muscles of the neck are involved, and also those of the face and trunk. Morse (Edinburgh Med. Jour., July, '99) says the only true pathognomonic symptom is spontaneous intermittent paroxysmal muscular contractions. The most common seat of these contractures is in the muscles of the forearm, the fingers being flexed at the metacarpophalangeal joints, while the phalanges are extended, the thumbs being strongly adducted, the wrists acutely flexed, and the hands turned to the ulnar side. The position of the hand is called the "accoucher's hand" or the "writing hand." Other attitudes are, however,

occasionally seen, such as a firm clutching or even complete extension of the fingers. The forearm may be flexed upon the arm, the arm adducted to the shoulder.

If the lower extremities are involved, the thighs may be adducted, the legs extended or flexed; the toes are apt to assume the position of talipes equinus. The spasms may affect the muscles of the abdomen, the back, the diaphragm, and the thoracic muscles; hence inspiration is endangered and cyanosis may result, even consciousness being lost (Weiss). Trismus is rare, yet opisthotonos is not exceptional. Other muscles may be affected, as of the eyes, the œsophagus, the pharynx, the larynx, or even the bladder. Laryngeal spasm is a common accompaniment of the disorder. Naturally, this degree of overtonicity may cause muscular pains. The degree of spasm varies, and also its length. It may last from two minutes to two hours or more. As has been said, the involvement of the muscles is symmetrical. Cases have been reported of one side only, or unilateral for a time. In the contracted muscles fibrillary twitchings have occurred; clonic movements almost never. Tremor is common. The spasm begins in the periphery, not from within outward, as in tetanus; nor are the masseters early affected, as in that more serious malady; nor is reflex excitability high; nor is the spasm continuous as in tetanus. During the intervals the patient is comparatively comfortable. The muscles are often tender and sore, and they are weakened. The intervals are variable: usually a few hours, or it may be several days or weeks. Other symptoms are those of Trousseau, already mentioned. This is the fact that, if, during the passive interval, the limb be grasped in such a way that the great nerves or arteries which lie along the

under surface of the limbs are pressed upon forcibly, the characteristic cramp can be made to return. It may require some continuance of this pressure to elicit the phenomenon, but when it is present it is regarded as pathognomonic of tetany. This is not always to be obtained: in perhaps only one-fourth of all cases. Its value is great in demonstrating the existence of "latent tetany": a form in which there is at no time a clearly-marked contracture. Chvostek's sign is rare in children. It consists in an extraordinary susceptibility of the nerves in tetany to mechanical impressions. A blow with a percussion-hammer over the facial nerve produces a twitching of the angle of the mouth or of all the muscles of the facial distribution.

The third important symptom of tetany, known as Erb's sign, is a greatly exaggerated electrical excitability of the nerves. Weak faradic or galvanic currents produce muscular contractions in excess of the normal response. Cathodal closure contractions are found with small currents, but also with moderate currents; also cathodal closure tetanus, and anodal opening tetanus, which are not observed in any other condition.

The most convenient test, and one which usually suffices in an affected person, is the increased mechanical excitability, a simple touch, a light pressure on nerve, being enough to produce contractions in the muscles supplied by it. It is less painful to the subject than to induce an attack by pressure on a large trunk or artery. (B. Sachs.)

Sensory phenomena are few; there are no disturbances of cutaneous sensibility. Headache, vertigo, nystagmus, and tinnitus aurium are described as co-existing. Temperature elevation is only

rarely produced, but may be present because of some underlying condition.

Respiration is not, as a rule, affected. Dyspnœa is sometimes produced by fixation of the muscles of the thorax and the diaphragm. The pulse is often increased in frequency. The urine is rarely affected; it may be increased in amount. Nephritis occurs occasionally. There are seen, at times, certain nutritive disturbances affecting the hair, nails, etc. The reflexes do not show any characteristic alterations, and are, as a rule, normal.

The duration of an attack of tetany is most variable. There may be many remissions of greater or less severity, of shorter or longer periods of abeyance.

Diagnosis. — The clinical picture of tetany is thoroughly characteristic, and should be easily recognized.

The position of the hands, the fingers grouped together or held rigidly in this or some other attitude, as in extension, the legs oftentimes affected, as well or both arms and legs firmly adducted, should instantly excite suspicion. On investigation the sign of Trousseau would reveal the condition even during the periods of latency; that of Chvostek (irritability to slight mechanical stimuli) and that of Erb (electrical excitability as described) should make the diagnosis clear. Morse regards the one symptom pathognomonic of tetany: the spontaneous intermittent, paroxysmal conditions of the muscles of the forearms.

Not all the characteristic symptoms are seen in each case, and the absence of some one or other does not vitiate the diagnosis.

The diagnosis of tetany is personally reserved for those alone in whom a spontaneous characteristic contracture occurs, and the habit which has arisen, of describing laryngismus stridulus—Chvostek's symptom and Trousseau's

phenomenon—as being symptomatic of tetany, is deplored. Cases in which such symptoms are grouped as latent tetany are never transformed into true tetany. It is only by holding strictly to this point of view that the clinical individuality of tetany as a disease can be maintained. Tetany is a disease resembling, in many respects, epilepsy, and having its origin in various predisposing causes, arising frequently in rickety children, without being a manifestation of that disease; frequently in children suffering from gastro-intestinal trouble, and occasionally at the commencement of the infectious fevers and acute illnesses. The toxins of ptomaines resulting from these various conditions have a functional rather than an organic effect on the central and peripheral nervous system, producing the characteristic spasm. Romme (*Gaz. Hebdomadaire de Méd.*, Jan. 24, '97).

Results in the study of 7180 cases of convulsions in children: 1. One per cent. of the children applying for treatment at the Children's Hospital came for convulsions. 2. Ten per cent. of children between five and twelve years of age gave a history of convulsions. 3. Cases that appear to be due to some manifest reflex cause may turn out to be true epilepsy. 4. Other cases, where the attacks occur frequently and without apparent cause, may suddenly recover; at least, for a considerable period. 5. Children who have had convulsions may be strong and free from nervous tendencies in later life, although the proportion who have nervous tendencies seems to be greater than in those who have not had convulsions. W. N. Bullard and C. W. Townsend (*Boston Med. and Surg. Jour.*, Mar. 7, 1901).

Etiology.—Tetany arises in certain localities, and is not seen again for long periods. It may become epidemic (Bruns). The condition was described by Trousseau originally, who discovered the important symptom known by his name, viz.: that an attack could be induced in an affected subject by compressing the arteries and the nerve-trunks.

Tetany occurs in both adults and children, in about equal frequency (B. Sachs), but most cases are seen in the very young. Holt says it is usually seen in early infancy. Barthez and Sanné found it more often in children and most in infants. Griffith found 66 per cent. under two years of age.

The disorder is much more common among the children of the lower classes, and those whose surroundings are unwholesome. It almost always follows upon depressing conditions, overexertion or recognizable disorders or diseases, especially the transmissible ones; hence its pathology is regarded as a toxæmia, or probably of a complex sort, perhaps a mere neurosis. It is frequently associated with rickets. Rarely it has resulted from a known poison, such as lead, alcohol, or ergot. It occurs as a finality to, or associated with, structural diseases of the nerves, and is known to result from extirpation of the thyroid gland. That the thyroid gland secretes something, the absence or excess of which is followed by a perturbation of the normal nervous balance, is a fascinating view, of which Ewald makes a strong point. Weiss pointed out the connection between these toxins and tetany. That intestinal parasites secrete a peculiarly disturbing toxin is urged by Albu and others. Maestro advocates the administration of thyroid gland, and exhibits clinical findings from this measure which are convincing; and, in this, S. S. Adams follows him confidently. Tetany was at one time regarded as an occupation neurosis, but Kussmaul corrected this view. Any exhausting disease is a possible cause of tetany in those predisposed to this form of motor disturbance. The connection of the disease with rickets is still a topic of discussion.

The etiology of tetany in childhood is not clear. It never affects healthy chil-

dren. Rachitis is of important predisposing influence. The direct cause of the attack is some gastro-intestinal disturbance, proved by the frequent association of tetany and acute dyspepsia, and the effect of treatment directed to such conditions. Hauser (Berl. klin. Woch., No. 35, '96).

Pathological Anatomy.—No constant nor characteristic lesion has been found present at autopsies in tetany. Serous exudation into the cervical cord and into the ventricles of the brain, sclerotic changes, spinal extradural hæmorrhage, atrophy in the ganglion-cells and nerve-fibres, and proliferation of the neuroglia are among the conditions found, as enumerated by Dercum.

The subject has been variously viewed by those who have made researches in this line (Langhans, Weiss, Gowers, Schlesinger, and others), and little other than speculations are offered. The facts are scanty as yet, and it is better to content ourselves for the present with the view that tetany is due to the effects of a toxin or toxins upon the entire nervous system in one so predisposed.

Romme (Gaz. Hebd. de Méd. et de Chir., Jan. 24, '97), reviewing the claims of various authors as to the etiology of tetany, concludes that the views of Kossowitz and his school (that it is a manifestation of rickets), and those of others who would ascribe the condition to any especial primary disease, are incorrect, as there are no constant post-mortem findings in tetany, and it occurs in connection with various diseases.

Clinical and pathological studies tell us only that the main symptoms are evidences of mechanical or reflex hyperexcitability of the cord and peripheral nerves due to a diversity of causes.

In an analytical study of 6822 children, with special attention to determining the nature of tetany and its relation-

ship to rickets and laryngeal spasm, Cassel (Deut. med. Woch., Jan. 28, '97) found 60 cases of tetany. The nutrition was good in 14, moderately good in 13, poor in 23, and bad in 10. All presented spontaneous intermittent spasm, which could be induced by pressure upon the large nerves and vessels of the affected parts. In all but 3 the facial phenomenon was present. Only 2 had laryngeal spasm, and both of these presented craniotabes in addition to other symptoms of rickets. Without exception, the children were nervous and slept badly. Fourteen presented a rise of temperature; in 9 the disorder was the result of complicating conditions, and in the remainder it arose without apparent cause. In 21 cases digestive disturbance preceded or accompanied the tetany, in 5 there was chronic dyspepsia, in 43 digestive disorder, in 6 obstinate constipation, and in 4 habitual vomiting. Rickets was present in 52 of the 60 cases; in only 8 there was no trace of rickets. Tetany was seen throughout the entire year, although the largest number appeared to occur in the spring and late autumn. There was no suggestion of an epidemic occurrence of the disease, nor was there any relation as to frequency between tetany, rickets, laryngeal spasm, and craniotabes. Cassel concludes that tetany is neither a complication of rickets nor of digestive disturbance, but is dependent upon unfavorable conditions of living, improper nutrition, and bad air.

The evidences point to the conclusion that tetany is a disorder of the nerves, somewhat generally distributed, and of toxic origin. It arises, almost always, in those who have suffered from exhausting conditions, depressing circumstances, or acute diseases, or all three.

Prognosis.—The prognosis of tetany, on the whole, is favorable. Most cases

recover. Sievers (Berl. klin. Woch., Nos. 31, 32, '98) notes two fatal cases which occurred in connection with dilatation of the stomach. In both there were stenosis of the pylorus from healed ulcers and enormous dilation.

In all the reports of fatal cases of tetany twenty-seven in number, there was usually found dilation due to stenosis from scars of pyloric or duodenal ulcers, or ulcer and scar without stenosis. Those cases which follow upon extirpation of the thyroid gland are usually fatal.

Treatment.—If rickets be accepted as the essential cause, it is plain we must determine what has produced that disease; and the findings of the foremost clinicians yet are limited here, also, to much the same factors as give origin to tetany. The disorder is one chiefly of excess of motion; and prodigality of motion—as I have constantly maintained, in dealing with disorders of motion, such as chorea—is always followed by exhaustion (fatigue neuroses); hence the fundamental need for all such states is absolute rest for both body and mind. The next indication is to remove all sources of peripheral irritation. The mass of evidence is in favor of gastro-intestinal irritation being the chief factor; hence the digestive organs will need fullest attention. As toxins are admitted to be the chief source of disturbance in tetany, eliminants are also in order. A few well-directed doses of calomel will meet many indications. Beyond this, and a regulation of diet, it is seldom needful to go. If the spasmodic phenomena are excessive or painful, it is well to proceed in the same lines as in dealing with convulsions. The inhalation of chloroform, or a mixture of chloroform, nitrite of amyl, and ether (parts 3, 1, and 5), will hold the spasm in check. Sedatives, such as the bromides, chloral, and hyoscine hydro-

bromate may then be used, or, possibly, morphine hypodermically. Finally nutritive tonics will be required in most cases, and to be maintained for a long time. (See CONVULSIONS.)

The thyroid treatment has been applied to tetany with some success. The thyroid gland was given raw or slightly cooked, and the dose, small to begin with, was carefully increased to 30 grains a day. In idiopathic tetany it diminished the intensity and the frequency of the attacks and shortened the duration of the disease. This treatment is not antagonistic to the symptomatic treatment, as it does not present any incompatibility with the methods ordinarily employed. Maestro (Lancet, p. 334, Jan. 30, '97).

Automatic Movements in Children.

Automatic movements may occur in the following diseases:—

I. Anomalous epilepsy.

II. Hysteria of childhood. General, quasipurposeful. Hysterical, salaam, and hysterical eclampsia rotans.

III. Athetosis (athetoid movements in asthenic conditions):

IV. Automatic rhythmical movements. These are better displayed in a table:—

Automatic rhythmical movements	{	Head-nodding and shaking	{	Movements of assent.
		Gyrospasm. Head-banging. Eclampsia nutans, or salaam convulsions. Eclampsia rotans.		Negative movements.

V. Tic convulsif.

VI. Induced automatic movements.

It may be advantageous to examine each division carefully and endeavor to define diagnostic features and differences, and in a few instances it is possible to assign a cause.

Anomalous Epilepsies.—In these forms there is exhibited a most marked display of automatic imperative movements. By relating a typical case a good concept can

be formed: A boy, aged 17; weakly, nervous, and irritable. The attack begins usually with a sharp cry and without further development. The patient commences to run aimlessly through the street, usually at a good speed. If stopped by anyone, he may struggle violently, or even pass into epileptic convulsions, from which he awakens exhausted, asks for water and promptly goes to sleep. His apparent oblivion to the external world, the inability to make any impression by speaking to him, his avoidance of collision with objects and people, and particularly his absence of remembrance when he awakes of events taking place during the attack, lead one to regard it a pure case of secondary consciousness of automatic and, usually, centric origin.

Some cases run round and round, only stopping to fall exhausted and senseless to the floor. Another variety manifests no motor excitation whatever; the patient will suddenly, in the midst of some rational action, wander quietly off by himself, accost persons on the street, and, at times, threaten to do violence if the one addressed does not agree to some absurd demand on his part. Then comes the awakening. The patient does not know where he is or how he got there, and exhibits signs of exhaustion and thirst.

The treatment of these cases is the same as that for idiopathic epilepsy.

Hysteria of Childhood.—In referring here to hysteria, we shall simply consider that type in which there are observed automatic movements.

Hysteria of childhood is a condition which frequently simulates anomalous epilepsy, and at times it is only with extreme difficulty that a differentiation can be made. Like epilepsy, there is often an initial scream, which differs in quality

from that of epilepsy, and which usually is not given until the patient is aware that she (usually a female) has an audience. The patient then falls to the ground in a way that she will not be hurt. At times a very fair representation of opisthotonos is presented. Engorgement of veins about the head is frequently noted, and more or less active tonic spasm is present. After this follows a condition of relaxation, with wild quasipurposeful movements of the arms; broken short sentences, explosions of passion and profanity, weeping, laughing, and grinding of the teeth often follow. The larger and more sympathetic the audience, the more varied and emotional will be the manifestations.

Anæsthesia, paralyses, hallucinations, and ecstasies have their turn, and gradually the patient quiets down to normal. The notable feature in these cases is the imperative and purposeful movements, mostly confined to the arms, which the patient will often assert, during the attacks, she cannot possibly stop.

[Dr. Alfred Reginald Allen, my assistant, aborted a most pronounced one of these seizures in a hospital case by an hypodermic injection of sterilized water with a dull needle. In another case of the same kind he used hypnotism, the sudden command, successfully. J. MADISON TAYLOR.]

Athetosis should never be confused with any other automatic condition, and all that need be said of it here is that when hysterical, or secondary to some functional or mild disorder, a good prognosis may be given, otherwise it should be guarded.

Automatic Rhythmical Movements.

In this term are broadly included head-nodding, or movements of assent; head-shaking, or negation movements (synonymous with spasmodic nutans and nictatio spatia); gyrospasm; head-banging;

eclampsia nutans, or salaam convulsions; and eclampsia rotans.

Head-nodding and head-shaking are manifestations which appear in the infant at any time between the ages of two and eighteen months. It is sometimes preceded by injury to the head, as might be occasioned by a slight fall. But the condition has appeared so many times when such history cannot be elicited that it would lead one to think injury not an essential factor in the etiology. In most cases the nodding and shaking are preceded a week or ten days by nystagmus, which may be vertical or horizontal, or vertical in one eye and horizontal in the other. At times there is only a uniocular nystagmus. When the nodding and shaking appear they are usually limited to a few attacks a day, which tend to increase in number. There sometimes appear cases in which there is almost constant nutans of a mild type, with strong exacerbations. In the great majority of cases the movements seem to be accentuated when the attention is distracted, or if the child makes an effort to hold his head still. Caillé (*Arch. Pæd. Soc.*, '89) reports cases where movements ceased when attention was fixed and also if eyes were bandaged. His treatment of the case was to keep the eyes bandaged for some weeks—only removing the dressing to flush out the conjunctivæ. Recovery ensued. The pupils are usually dilated, the eyegrounds normal. The few cases in which fundus changes have been found are coincidental. Occasionally there occur periods of unconsciousness, with marked deviation of eyes to right or left (Hadden).

Very frequently there is a history of rickets, and the rosary and other features are well marked. In most of Hadden's cases there occurred, as an early symptom, the throwing back of the head and

looking at objects with partially-closed eyes.

Head-nodding is much rarer than head-shaking. Occasionally these alternate in the same patient.

If it be desirable at this time, with our limited knowledge of this condition, to classify them under any particular heading, hysteria in childhood would seem to present the greatest claim, for in hysteria there are frequently salaam movements, pure and simple. Until more is known of the essential nature of those conditions, and their relation to the few different lesions which have been found in the brain at death, it will be an impossibility for us to go further than to offer surmises as regards a classification. They are so frequently associated with defective mental development that the suspicion of their being significant of some deep-seated developmental error is urgent.

When a combination of motor impulses by their cross-action imparts a rotary motion to the head, this is known as gyrospasm (Peterson). These spasmodic conditions sometimes increase during sleep. According to Peterson, the number of excursions of the head in these affections rarely exceeds two or three a second. The child may only have an attack during the night, or it may be so persistent that it suddenly awakens him every time he composes himself for sleep.

[The following is a case of gyrospasm of my own hitherto unreported: B. S., aged 6 months, female, Russian Hebrew, of excellent family history,—mother a large, vigorous woman with abundant breast-milk,—was brought to Polyclinic Dispensary for relief of gyrospasm. One older child, perfectly strong, was also breast-fed. This infant was regarded as exceptionally vigorous, had never been ill, held up its head at three months, and had no convulsions. Automatic movements began ten days ago without

ascertainable cause. The first movement was forward-and-back nodding, alternating with a slight rotary action, noticed from time to time during the morning only. On the second day movement was more marked and constant, the series consisting of two or three nods, followed by fifteen or twenty rapid rotations, then a quiet interval. In all there were perhaps twenty paroxysms during the day; these are now continuous, and do not altogether cease during sleep.

On examination the infant seems perfectly normal in other respects; is cheerful and intelligent, of good color, and well nourished. On endeavor to make the child fix its eyes or converge them the movements cease for a few seconds, and are replaced by lateral nystagmus, but soon the gyrospasm recurs with increased force. Lowering the eyes, the head leaning forward, also brings relief. The case recovered entirely in a short time. J. MADISON TAYLOR.]

In eclampsia nutans and rotans there is a bowing, or salaaming, movement of the neck. Hadden differentiates those conditions from head-nodding and head-banging, and calls eclampsia nutans and rotans a variety of epilepsy.

In anomalous or aberrant forms of epilepsy there is a salaaming, but also there are other signs of epilepsy.

A perfectly analogous condition to all the above automatic imperative movements may be induced by suggestion under hypnotism.

Other motor neuroses—such as habit chorea, habit spasm, convulsive tics, echolalia, coprolalia—are dealt with elsewhere.

A curious case was reported by Sée (St. Barthol. Hosp. Rep., '86) in which the brother of a case of head-banging was similarly affected while sleeping in the same bed. The symptoms disappeared immediately on the separation of the children.

Treatment.—The treatment of head-movements is change of air and climate,

and nutritious food and out-of-door life, as much as possible; in short, improved hygiene, careful search being made for and correction of any source of reflex irritation, such as post-nasal adenoids, adherent prepuce, phimosis, dentitional disturbances, intestinal disorders, intestinal parasites, etc.

Most of the sufferers are too young to warrant the correction of errors of refraction, though they may readily exert an influence. The condition of any of the aforesaid irritations may solve the difficulty. It is safe, nevertheless to begin at once on a treatment by sedatives. Bromides, valerian, chloral, etc.; nutritive tonics, such as codliver-oil, iron, phosphorus; fatty and albuminous foods, and the organic nucleo-albumins are likewise indicated. H. C. Wood likens these conditions to those of chorea, which is due, in his opinion, to depression of the inhibitory centres governing the anterior cornual cells of cord. He accordingly recommends quinine as an inhibitory stimulant.

Convulsions.

A convulsion is a temporary overflow of motor impulses producing purposeless muscular contractions, alternating with relaxations for shorter or longer periods, attended by more or less loss of consciousness. If the alternations are rapid, the form is called clonic; if slow, the contractions being maintained for a variable time, it is called tonic. A spasm is a more or less rapidly alternating contraction and relaxation of certain muscles or groups of muscles affecting a limited portion of the body; it is essentially local, and, as a rule, does not involve the centres nor disturb consciousness. A tremor is a rapid rhythmical vibration in the muscles. Convulsions may be epileptiform, hysteroidal, or tetanic. In epileptic and

hysteroidal convulsions consciousness is disturbed because these emanate from the brain-centres. In the tetanic form this is peripheral, and not central. In epileptic convulsions consciousness is lost or severely impaired, as a rule. In hysteria this is also true at times, wholly or in part, but is not to be expected. Local spasms may occur as disturbances of motion in the muscles of the vital organs, such as œsophageal, rectal, urethral, and the like. Vomiting is a local spasm; so are certain forms of nervous croup. Spasms of voluntary muscles in young children produce such alarming effects as laryngeal spasm, or laryngismus stridulus, child-crowing, and the like.

Automatic movements are irregular, involuntary muscular acts, more or less co-ordinated, and simulating voluntary acts.

Infantile Convulsions. — Convulsions occurring in young children constitute a symptom, not a disease. They vary widely in severity, beginning locally and becoming general, or they may prove to be overwhelming motor discharges so intense as to cause serious disablement or possible death. Modern writers deny the gravity of infantile convulsions, so far as immediate results are concerned, but readily admit that very grave subsequent effects often follow.

After-history personally studied in 85 cases of infantile convulsions, 40 of whom suffered from pronounced neuroses in later life. Of these 11 had epilepsy of a severe form, 14 had *petit mal*; 5 suffered from somnambulism, 4 from melancholia, 7 from chorea, and 9 from migraine. Of the 45 who were free from definite neuroses, 8 were pronouncedly eccentric, and nearly all the rest were below the average intelligence of their brothers and sisters. Coutts (Brit. Med. Jour., Apr. 19, '99).

Symptoms. — Almost anyone of moderate intelligence will readily recognize

a well-marked convulsion or even a convulsive tendency; but it is of the utmost importance that the first observer shall carefully note and be able to relate accurately the starting-point and phenomena of progress, the degree of severity, and the length of time it has persisted. On these facts will depend a proper diagnosis of the character and seat of the irritation. The slightest twitching of the thumb may indicate irritation or disease near the thumb-centre. So twitchings of the eyelid or movements in and around the corners of the mouth point to central disease. Unilateral convulsions do not necessarily indicate a local lesion, although they form a fair ground for suspicion of focal disease. There is usually some prodromal symptom more or less brief, such as slight twitchings alluded to in the muscles of the extremities or face, a general restlessness, and startings upon slight irritation from touch or noises. Immediately before the convulsion there is often pallor, a fixity of the eyes, or they may be rolled up into their orbits; these slight, isolated movements may pass into convulsive twitchings, extending rapidly over the entire body, or shifting from one side to another, or from one limb to the opposite one along with, or alternating with, movements in the face or head, retraction of the head, or rolling of the body over to one side or the other.

A succession of grimaces due to contraction of the facial muscles may be the only early change seen; or later the hands may be clenched, the thumbs being buried in the palms; the great toe extended downward—"carpo-pedal spasms"—or these phenomena again may be followed by a general commotion; frothing at the mouth; disturbed respiration and pulse, slow or rapid, usually irregular; sweating of the forehead, and

blueness of the lips and face. The sphincters may become relaxed, urine and fæces being passed involuntary. After the fit there is usually evidence of prostration, and temporary palsies not infrequently follow, due to exhaustion of the nerve-centres. One attack of convulsions is commonly followed by others, exhibiting an increasing susceptibility. Convulsions coming on in a child previously well point to some acute disease of exceptional severity, or possibly acute meningitis. Convulsions occurring in most forms of brain disease are not usually accompanied by marked temperature-rises, but are liable to exhibit pupillary changes, strabismus, rigidity, or localized palsies.

Etiology.—Convulsions, local or general, arise in excessive and irregular discharges of nerve-centres in the cortex or base of the brain. Nothnagel suggests a convulsive centre in the pons.

Experiments by Suschtschinski and Wyrubow (von Bechterew in *Neurol. Centralb.*, No. 4, '97) have shown that the convulsions caused by irritation of the pons are not the effects upon a convulsion centre, but due to the transmission of irritation to the cerebral hemispheres and especially the motor cortex.

The seat of discharge in convulsions is presumably in the ganglion-cells of the brain, and molecular disturbances in these cells necessary to the morbid discharge are determined either by direct irritation of those centres or reflexly through peripheral irritation. The phenomena have to do with exaltation of the lower centres or loss of inhibition in the higher centres, or both.

In infants the nervous system is structurally immature, but in process of rapid development. Even after structural completion time is required to attain functional stability.

At birth the lower centres only are developed; hence control is limited until the higher centres become competent to exert inhibition. In the earlier months of life convulsions are common, progressively less so after birth to the first year of life (Kassowitz), and are more rare after the second year.

It is unusual, perhaps impossible, for a healthy child to suffer from convulsions, unless the exciting cause be overwhelming, such as trauma, an intense irritant, or poison. Convulsions readily occur in children of unstable equilibrium. This dangerous condition may arise from inheritance or become acquired, and is of very varying degree. One convulsion predisposes to another, and the habit may become fixed.

Some families are especially prone to suffer ill effects from motor excitements, or their infants offer but feeble resistance to excitants, be these physical or psychical. Again, individuals vary from time to time, and are rendered susceptible by depressing causes, nutritional and emotional, as well as by the onset of definite disease.

Exciting causes are chiefly reflex from peripheral irritations, inducing overactivity in convulsive centres. The history of many of these must be received with caution, since deeper causes can usually be found where careful search is made, more probably several causes acting together: vasomotor instability, temporary or prolonged; states of anæmia, variations in blood-supply and quality, along with states of certain special nerve irritation, as that of the fifth or gastro-intestinal supply and rickets, the extremes of heat and cold, produce conditions which react in convulsions readily to relatively slight exciting causes.

What part is actually played by disordered dentition is not determined, but

the weight of modern evidence is against this being of great significance. Some go so far as to assert that it is absolutely *nil*, others admit that it exerts some positive influence. Certainly it is not shown to be a large factor. The lancing of the gum over an approaching tooth often relieves the spasm. In the same category of doubtful causes may be mentioned the presence of intestinal parasites, where removal is, however, of practical value.

Convulsions in male children are so often dependent upon an adherent prepuce that one should make it a rule, in such cases, to look for this condition and relieve it. Ewing (*Phila. Med. Jour.*, July 1, '99).

Of the determining causes, by far the most important is the use of improper food, unsuited in amount, kind, or condition to the needs of the young child. This acts often as both fundamental and exciting cause. Milk from a mother or wet-nurse may be vitiated by various causes,—fatigue, emotional,—or it may act as a medium of poisons,—such as alcohol,—and has been known to cause convulsions.

A nursing infant is often most seriously disturbed, and sometimes even thrown into violent convulsions, by changes in the lacteal secretion brought about by unusual or excessive coitus. A. C. Cotton (*Phila. Med. Jour.*, July 1, '99).

Other determining causes besides the visceral sensory distribution (gastro-intestinal) are such as disordered dentition (fifth nerve); the various infections, especially whooping-cough, syphilis, scarlatina, and the other exanthemata; ptomaines and leucomaines, uræmia, malaria, heat, cold, febrile states, burns, fatigue and depressing influences, blood-loss, shock, emotions, fright, anger, etc. Of poisons, some are the toxins generated within the organism alluded to, and others are swallowed, among which

should be borne in mind lead, alcohol, etc.

Interesting cases were reported by D. D. Stewart among a series of children poisoned by lead used as coloring matter in cakes. Meunier reports cases of convulsions caused in nursing where the nurse took large amounts of alcohol. Many of these causes are aggravated by meteorological conditions, especially of hot weather in summer. It has long been believed that convulsions frequently occurred as a prodrome in pneumonia, but Gossage and Coutts show a series of 166 cases with this symptom in only 8, or 4.7 per cent.

Convulsions—and these the more serious ones—are also due to various forms of cerebral disease: hæmorrhage, internal pressure as from rapidly increasing hydrocephalus or abscess, and emboli and thrombosis, and, above all, rickets. Only a small proportion of cases of convulsions, however, are demonstrated to occur in children who have evidences of rickets. In them motor disorders are more likely to be tetany and laryngospasm. The brain presumably suffers from malnutrition in all these disorders, and to this the instability is due.

Prognosis.—In estimating the dangers resulting from convulsions it is necessary to consider the nature and extent of the cause. In children of a markedly unstable nervous equilibrium a convulsion may mean little or nothing. Moreover, moderate convulsions occurring in young infants are of small import. Fits appearing as prodromes of acute febrile diseases are rarely serious and may not even indicate an unusually severe attack of the disease. When they occur after the establishment of the characteristic features of the disease they are of deeper significance, and may indicate the oncoming of nephritis, meningitis, or other grave com-

plications. Those points on which one is likely to base a serious prognosis are extreme prolongation or frequent recurrence of the convulsions; also profound disturbances of the circulation, stupor, or subsequent prostration.

Gossage and Coutts lay great stress on the facts that the danger of future neurotic manifestations has been underestimated; predisposing causes are of more importance than the exciting causes; and that the slighter exciting causes will not produce convulsions except in children so predisposed. Statistics were produced at the 1899 meeting of the British Medical Association, showing that over one-half of the patients who had exhibited convulsions in infancy suffered from some form of neurosis. And they were not so much to be ascribed to the malnutrition of the nervous system in infancy or to damage during the convulsive stage as to congenital faulty development. This particularly in children of gouty, nervous, rheumatic, or diabetic parents, and it is in whom such a family diathesis is known to exist that any extreme of reflex irritation must be repressed or it will result in a nervous explosion.

Treatment. — The treatment of convulsions divides itself in two very unequal halves: to overcome the symptom and to master the underlying condition. The indications, for the first, are to hasten to the case with all speed, to promptly secure various items of equipment, which may, any or all, be needed, but the absence of any one of which may cause serious embarrassment, possibly danger of life.

A severe or continued condition of convulsions may produce serious damage to remote organs and tissues. The explosion may be overcome by the inhalation of chloroform, which, in the condition of such a state of nervous exaltation,

is quite safe. To this may be added, with advantage, nitrite of amyl and sulphuric ether. The mixture I have used for years most successfully in the paroxysm of pertussis is equally applicable here: amyl-nitrite, 1 drachm; spt. of chloroform, 3 drachms; ether. sulph., 5 drachms. It is well to loosen the clothing, or, better, to promptly remove them. Thus, many important points may be revealed. Often the child will be found in a bath of hot water, perhaps mustard is added. In the excitement this may have been so hot or irritating as to cause damage, and it is best to remove the child at once, and it may be necessary to investigate the condition of the skin and apply emollients. If not in a bath, it is often useful to apply mustard pack—which consists of 1 teaspoonful of dry mustard rubbed up with 1 ounce of water and added to a quart of hot water, and into this a sheet, or bath-towel is dipped and wrapped around the child. After this has been applied for a suitable time, or during the continuance of it, a careful search should be made for various sources of reflex irritation. The chief of these may be found in the digestive tract, and the next routine procedure to be recommended is to apply a cleansing enema. This enema serves several valuable ends in removing feces or undigested food, and, if hot, aids in stimulating capillary relaxation. If the temperature be found high, this can be followed, with advantage, by a cool enema. If subnormal, as is the case frequently in the convulsions following summer diarrhoeas, a salt enema supplies fluid by imbibition, or hypodermoclysis may be even better. I have seen lives saved by this. In hyperpyrexia cold to the head is in most cases a useful measure. If congestive states are pronounced, local blood-letting by leeches is of much use, and is recom-

mended by Baginsky and others. Lumbar puncture is a safe measure too, and this I have done with great satisfaction many times. If the convulsions be unduly prolonged, the use of morphine hypodermically is both safe and gratifying. If the first dose (of, say, $\frac{1}{48}$ grain to a six-month-old baby) is not sufficient, a second may be given in an hour, of double the first dose, and again, in an hour, double of this, if needed.

Where there is asphyxia or marked cyanosis, oxygen is a valuable agent; this is best administered to infants through a large face-piece and one straight tube. When the bowels are sufficiently cleared sedatives can be administered by the rectum; chloral and the bromides are most used. For a six-month-old baby, 4 grains of chloral or 6 grains of bromide of sodium or strontium, one or both, may be given; for a baby of one year, 6 grains of chloral and 10 of a bromide is a suitable dose, to be repeated again at hourly intervals if needed. Authorities differ as to whether an emetic should be employed; but, if there is reason to believe that there is undigested food in the stomach, this should be used; and, while there may be theoretical objections, I have no reason to believe that harm has been thus caused. Emesis in children is so readily induced that there need be little fear of injurious effects unless excessive stimulus is employed by overdosing with emetics. So soon as the child can swallow, it is well to give a grain or two of calomel, which acts usefully in several ways, even if it does not purge. To produce a full laxation, where this seems necessary, milk of magnesia, castor-oil, or some other active drug can be employed. After having instituted these measures to overcome the activity of the convulsion a thorough search should be made for such sources of reflex

irritation as phimosis, an approaching tooth, foreign bodies in the nose or ears, etc. As soon as possible, the history of the case should be scrutinized for remoter conditions, such as the existence of a pneumonia, the possibility of the beginning of an exanthem, etc. It must be borne in mind that the occurrence of convulsions is much more frequent and vastly more dangerous during the progress than at the beginning of either pneumonias or the exanthemata. If they arise at the end of an exhausting disease, as of those two just mentioned, or of a prolonged diarrhoea, the process is essentially different and will call for other measures. If the urine contains albumin, which must be ascertained without delay, diaphoresis is important; but diuresis must not be neglected, and here repeated injections of warm salt solution through the bowel is of value, or also hypodermoclysis. Among the acute conditions which are competent to produce convulsions in healthy children are injuries to the head, which are liable to be followed by shock and are to be treated as such by external heat, cold to the head, and stimulating enemata. Sun-stroke and heat-exhaustion call for appropriate treatment; in the former, external cold is indicated, and, in the latter, heat and stimulants, of which among the best is coffee. An accidental cause may be mechanical obstruction of the upper air-passages, and, if apnoea is the chief difficulty, the introduction of a tongue-depressor, drawing the tongue firmly down and forward, may remove the symptom almost immediately. Lastly, it must not be forgotten that convulsions may be a phenomenon of impending death, when it is impossible to expect to relieve them; although it is oftentimes admissible to make use of strychnine hypodermically

and in large doses, and of other forms of stimulation.

Phosphorus in the convulsions of infancy exerts a more decided calmative influence on the nervous system in infantile eclampsia than does chloral or bromides. After carefully examining and cleansing the gastro-intestinal tract, the drug is administered for two or three days, in doses usually employed in rickets. Lange (*Semaine Méd.*, No. 3, 1900).

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SPECIFIC INFECTIOUS FEVERS.

Relapsing Fever (Famine Fever).

Definition.—An infectious fever caused by Obermeier's spirocheta characterized by a febrile paroxysm of about six days' duration, followed by a remission of about equal length, and one or more relapses of both paroxysm and remission.

Symptoms and Diagnosis.—Relapsing fever has not been met with in this country since 1869, when it occurred in New York and Philadelphia in epidemic form. The period of incubation is thought to be short: a week or less. The early symptoms are not characteristic: severe pain in the back and joints, chills, fever, and, particularly in young subjects, nausea and vomiting. Convulsions are occasionally observed in children. The pulse is rapid: 110 to 140 or more; and the temperature is high: 103° to 105° F. This parallelism is important, since it serves to differentiate relapsing fever from influenza, which disease it resembles. An attack of malarial fever is also suggested, the spleen being more or less enlarged almost from the start and profuse sweating being common. But the delirium which accompanies a high temperature, the prolonged duration of the paroxysm, the gastric symptoms, which are usually severe, serve to invalidate such a diagnosis. Typhoid fever is simu-

lated in many instances, especially when petechiæ, which are sometimes observed, are present; but the rapid decline of practically all active symptoms after a few days clearly indicates the absence of this affection. Again, intestinal symptoms, except toward the crisis, are uncommon. Many manifestations of varying nature may appear in the course of the disease: jaundice, cough, parotitis, cervical adenitis, orchitis, œdema of the feet, monarticular or polyarticular inflammations, laryngitis, and glossitis. Again, various eruptions may appear: roseola, purpura, urticaria, herpes, and the rashes of scarlet fever and measles. Hæmatemesis, hæmaturia, and epistaxis are occasionally noted. The most serious complications observed are pneumonia and acute nephritis. The intensity of the symptoms steadily increases, as a rule, until the crisis appears: from three to seven days after the onset of the access. Diarrhœa and sweating are often the first signs of the remission; a rapid decline of temperature, to the normal or below, follows, and the period of convalescence begins.

In about one-third of the cases the fever does not return; in the remainder a new attack appears after a week's comparative comfort. The previous symptoms once more prevail, and are followed, as in the former experience, by a sudden crisis, a period of repose, and a third attack. As a rule, the disease ends here; but two more recurrences may appear, each successive attack increasing the patient's exhaustion. In weak and aged individuals death may thus be brought about; but, as a rule, the fatal issue occurs during or at the end of the first access. Deaths from rupture of the spleen have been reported. The fatality of the disease is small, being but 1.26 per cent. during the epidemic which occurred in

Moscow in 1894, but it may reach 6 per cent., as was the case in the St. Petersburg epidemic.

Ulcerative conjunctivitis, various forms of paralysis, and the various complications occurring after exanthems are occasionally observed as sequels to the affection.

Etiology and Pathology.—Poverty, filth, insufficient or poor food, and other unhygienic conditions prepare the system for the invasion of the organism: a spirillum, or spirocheta. This micro-organism, a filamentous spiral, may readily be recognized in the blood, during the paroxysm, by its rapid movements among the red corpuscles. It disappears with the attack, and is superseded by what is thought to be its spores.

Of 29 inoculations in the monkey, there were 5 failures, and the incubation period was found to vary between two and four days, with one exception, in which it was prolonged to eight days. The blood may contain spirilla in small amount for a short period before the onset of fever. At the onset of fever the polynuclear cells are noticed to be much increased in number. Contrary to Carter's opinion, a considerable immunity, lasting for some time, was conferred by one attack. Living spirilla were found to be still present in the spleen when they had disappeared from the blood, and the spleen was observed to be poorer in antibactericidal substances than the circulating blood. From these and other considerations the following theory of the relapses in the disease is enunciated: At the crisis some of the spirilla perish, but some survive and are protected against the full power of the antibactericidal substances, and under this protection grow and multiply in the spleen during the period of apyrexia. Toxins would then be produced, and in a short time so modify the blood as to diminish the antispirillar substances to such an extent as to permit of the spirilla again living in that medium. Captain Lamb (Scientific

Memoirs by Med. Officers of the Army of India, Part XII; Practitioner, Sept., 1901).

It is thought that the medium of transmission is through suctorial insects. Tic-tin (Centralb. f. Bakt. Parasit., etc., Feb. 15, '97) studied this question during an epidemic which occurred at Odessa, Russia, in which 10,000 cases occurred. Hungry bed-bugs were allowed to bite a monkey that had the spirilli in his blood, and the blood of the insects was then examined. Organisms were found that were active for some time. A healthy monkey being then inoculated with this blood by injection, it rapidly developed the disease.

The morbid changes are not very marked; the spleen may, however, be greatly enlarged and soft, and the other viscera show evidences of degeneration. Nathanson noted changes in the cardiac ganglia, the degenerative process involving the protoplasm and the nucleus.

Phagocytosis occurs in the circulating blood in relapsing fever. In examining the blood of a patient shortly before death fragments of spirilla discovered in many of the leucocytes as well as large numbers of more perfect spirilla in the plasma. The intracellular spirilla stained but feebly, and were apparently in process of disintegration. Subsequent examination of the blood of a large number of patients suffering from relapsing fever showed similar appearances in all, and the same was true of the blood of a large number of artificially-immunized monkeys. Indeed, in these last the spirilla could be detected only in the corpuscles; none were found in the plasma. The inference drawn is that the immunity in these cases is due to heightened phagocytosis. Ivanoff (Centralb. f. Bakt. u. Parasit., xxii, 117, '97).

Sex and age do not seem to influence the development of the disease, though the mortality among women and old subjects is greater. It is thought to be con-

tagious and to afford no immunity against subsequent attacks.

Treatment.—Quinine is absolutely useless, except as a tonic during convalescence, and no medicinal treatment seems to curtail the attacks or prevent them. Symptomatic treatment, coupled with hygienic measures and nutritious, though easily-digested, food are indicated. An antispiretic serum has recently been used with apparent success.

Glandular Fever. — This is an infectious disease of children, having, as a rule, no prodromata, and characterized by slight redness of the throat, a marked febrile movement, and enlargement and tenderness of the lymphatic glands of the neck, especially those behind the sterno-cleido-mastoid muscles. The febrile movement is of short duration, but the glandular enlargement persists for a period varying from ten days to three weeks. (This disease should not be confounded with glanders or farcy, which is an entirely different disease.)

SYMPTOMS.—The onset is sudden, pain on moving the head and neck being the first noticeable symptom. There may be some abdominal pain, accompanied by nausea and vomiting. The temperature ranges from 101° to 103° F. The tonsils may be slightly congested and the lymphatic tissues swollen, but the throat symptoms are of slight importance and of short duration. The glandular enlargement appears on the second or third day, and while it lasts the glands may vary in size from a pea to a goose-egg. The glands are painful to touch or pressure, but there is rarely any redness or swelling of the skin covering them, though there may be, occasionally, some puffiness of the subcutaneous tissues of the neck and a slight difficulty in swallowing. When the tracheal and bron-

chial glands are involved, as they may be, there may be a feeling of discomfort in the chest, with a spasmodic cough. The glandular swelling usually continues for two or three weeks. The complications reported in this disease are supuration of the swollen glands (Neumann has reported thirteen cases), hæmorrhagic nephritis, acute otitis media, and retro-pharyngeal abscess.

DIAGNOSIS.—The diagnosis of this disorder is easy, as the symptoms are characteristic.

ETIOLOGY AND PATHOLOGY. — Glandular fever may occur in epidemic form. West, of Bellaire, Ohio, describes an epidemic of 96 cases in children between the ages of seven and thirteen years. A marked feature in these cases was a bilateral swelling of the carotid lymph-glands. In three-fourths of the cases the post-cervical, inguinal, and axillary glands were involved. The mesenteric glands could be felt in 37 cases, the spleen was enlarged in 57, and the liver in 87 cases. There was no coryza and no bronchial or pulmonary symptoms. The cases occurred between the months of October and June. The nature of the infection is not known.

PROGNOSIS.—The prognosis of this disease is generally favorable. The complications mentioned above render the outlook more grave.

TREATMENT.—The treatment is mainly symptomatic.

The treatment of glandular fever is symptomatic. The use of small doses of calomel at the outset has, according to different observers, been of particular benefit. Small doses of salophen personally employed have seemed to relieve the pain and the general malaise. The administration of iron is necessary during convalescence. Locally belladonna ointment in conjunction with lanolin may be employed. A. E. Roussel (*Med. and Surg. Reporter*, Apr. 17, '97).

Terminal Infections.—It may seem paradoxical, says Osler, but there is truth in the statement that persons rarely die of the disease with which they suffer. Secondary infections, or, in hospital parlance, terminal infections, carry off many of the incurable cases. Flexner, of Philadelphia (*Jour. Exp. Med.*, i, '96), has analyzed 255 cases of chronic cardiac and renal disease in which complete bacteriological examinations were made at autopsy. Excluding tuberculous infection, 213 gave positive and 42 negative results.

The infections may be general or local. The latter are very common and are found in a large percentage of all cases of chronic nephritis, arteriosclerosis, cardiac disease, hepatic cirrhosis, and other chronic disorders. The most frequent lesions are affections of the serous membranes (acute pleurisy, peritonitis, or pericarditis), meningitis, and endocarditis. Osler advances the opinion that it is perhaps safe to say that the majority of cases of advanced arteriosclerosis and of Bright's disease succumb to these intercurrent infections. Of the infective agents, Osler mentions the streptococcus pyogenes as perhaps the most common, but the pneumococcus, staphylococcus aureus, the bacillus proteus, the gonococcus, the gas bacillus, and the bacillus pyocyaneus are also met with.

In connection with the terminal form of acute miliary tuberculosis, Osler notes the great number of cases of arteriosclerosis of chronic heart disease, of Bright's disease, and especially of cirrhosis of the liver, in which death is determined by an acute tuberculosis of the peritoneum or pleura.

Flexner has found that the general terminal infections are less common. Of 85 cases of chronic renal disease in which he found micro-organisms at autopsy, 38 exhibited general infections; of 48 cases

of chronic cardiac disease, in 14 the distribution of bacteria was general. He found the blood-serum of persons suffering from advanced chronic disease to be less destructive to the staphylococcus aureus than normal human serum. Other diseases in which general terminal infection may occur are Hodgkin's disease (pseudoleukæmia), leukæmia, and chronic tuberculosis.

Finally, Osler observes that the terminal enterocolitis so frequently met with in chronic disorders is probably of the same nature.

Malta, Mediterranean, or Undulant Fever.—This disease, called by various names, is an endemic fever characterized by an irregular course, undulatory pyrexial relapses, profuse sweats, rheumatic pains, arthritis, and an enlarged spleen (Osler). The disease is met with at Malta, and in the countries bordering on the Mediterranean. In Gibraltar it is known as rock fever, and in Italy and Sicily as Neapolitan fever. It is probably also met with in India and China. Our knowledge of this disease is almost entirely owed to the labors and reports of Marston, Bruce, Hughes, Durham, and other army-surgeons stationed at Malta and Gibraltar.

SYMPTOMS.—The period of incubation is from six to ten days. "Clinically the fever has a peculiarly irregular temperature-curve, consisting of intermittent waves or undulations of pyrexia, of a distinctly-remittent character. These pyrexial waves, or undulations, last, as a rule, from one to three weeks, with an apyrexial interval, or period of temporary abatement of pyrexial intensity between, lasting for two or more days. In rare cases the remissions may become so marked as to give an almost intermittent character to the febrile curve, clearly distinguishable, however, from the paroxysms of paludic infection. This pyrexial

condition is usually much prolonged, having an uncertain duration, lasting for even six months or more. Unlike paludism, its course is not affected by the administration of quinine or arsenic. Its course is often irregular and even erratic in nature. This pyrexia is usually accompanied by obstinate constipation, progressive anæmia, and debility. It is often complicated with and followed by neuralgic symptoms referred to the peripheral or central nervous system, arthritic effusions, painful inflammatory conditions of certain fibrous structures, of a localized nature, or swelling of the testicles." (Hughes.)

Three distinct types of the disease are recognized by Hughes: A malignant type, in which the disease may prove fatal within a week or ten days; an undulatory type (the common form), in which the fever is marked by intermittent waves, or undulations, of variable length, separated by periods of apyrexia and absence of symptoms, the duration of this undulatory form being from three months (the average time) to two years, the patient suffering a series of relapses; finally, the intermittent type, in which the patient may have daily fever toward evening, without any special complications, and may do well and be able to go about his work, and yet, at any time, the other serious features of the disease may develop.

DIAGNOSIS.—This fever must be differentiated from typhoid fever and from malaria. A close study of the temperature-curve and the characteristic symptoms will facilitate the diagnosis. Moreover, the absence of specific action of quinine and arsenic and the absence of the *Plasmodium malarix* in the blood distinguish it further from malaria.

ETIOLOGY.—This disease prevails in summer, and in infected sections is en-

demic, occasionally becoming epidemic. Lack of proper sanitation favors its spread. Hughes believes that the poison is conveyed in the air and is related to defective drainage, while Bruce believes that water is the carrier. Young, healthy adults are the chief victims of this disease; the disease is non-contagious. An organism called the micrococcus melitensis by Bruce, its discoverer, is present in all cases, having been found by him in large numbers in the spleen, but not as yet isolated from the blood. This organism is round or slightly oval in form, and measures, in dried preparations, about 0.33 micromillimetre in diameter. A magnifying power of from 1000 to 1500 diameters is required for its detection. Viewed in a drop of water, unstained, the microbes are seen as bright points in active molecular movement, the great majority of them single, a few in pairs, and sometimes in chains. They possess no power of spontaneous movement. They can readily be stained in a watery solution of gentian-violet, but they become decolorized by Gram's method. Alcohol at once removes all color from the microorganisms, even after fixing them with osmic acid, corrosive sublimate, or tannic acid. In nutrient peptonized broth, kept at 98.6° F., no change is visible for the first few days, but after some time the fluid becomes decidedly cloudy without any formation of pellicle on the surface. The best culture-medium for this coccus is a 1.5-per-cent. peptonized agar-agar beef-jelly.

The character of the micrococcus melitensis has been investigated by H. E. Durham, who has found that inoculations into monkeys produce a disease similar to that in man, and the micrococcus can be isolated from the infected animal. A characteristic serum-reaction is present. It is probable, from Durham's experi-

ments upon animals, that the specific coccus may be isolated from the urine even after apparent recovery.

Bruce isolated the specific organism of Malta fever—*micrococcus melitensis*—from the spleens of nine patients who had succumbed to that disease, and placed the study of the affection upon a more definite working basis. Personal case in which, as there was a question of typhoid fever, Widal's test was used, with the result that agglutination was not obtained. Treatment of the patient's blood-serum with a pure culture of the *micrococcus melitensis* caused the appearance of the agglutination phenomenon in a few minutes, thus establishing the diagnosis of Malta fever. Torras y Pascual (Rev. d. Cien. Méd. d. Barcelona, No. 11, 1903).

PATHOLOGY.—No characteristic morbid lesions have been discovered.

PROGNOSIS.—The mortality of this disease is low: only about 2 per cent. The gravity in this disease lies in its protracted course; in the British army stationed at the various Mediterranean ports the loss of time is a serious item.

TREATMENT.—The general measures suitable to the treatment of typhoid fever are recommended by Osler in this disorder: Fluid food during the febrile period and hydrotherapy, either the bath or cold pack, every third hour when the temperature is above 103° F.; otherwise the treatment is symptomatic, as no drug appears to have any specific action on the disease. Convalescence is, in many cases, hastened by a judicious change of climate.

Dengue.—Dengue (break-bone fever, dandy fever, bouquet, bucket-fever, eruptive articular fever, eruptive rheumatic fever, dingee, denguis, etc.) is an acute infectious disease of tropical and subtropical regions, somewhat resembling remittent fever, but more severe. It is characterized by high fever; pain in the head, eyeballs, back, joints, and muscles;

a catarrhal inflammation of those mucous surfaces that are exposed to the air; swollen glands; an initial erythematous and a terminal polymorphous eruption, and a tendency to be continued for several weeks by intermittent attacks of short duration. It derives the name "break-bone fever" from the severe character of the pain, and "dandy fever" from the stiff, dandified gait assumed by those affected with this disease.

SYMPTOMS.—After a period of incubation of from three to five days, during which the patient feels perfectly well, the attack begins suddenly with severe frontal headache, vertigo, a sense of chilliness or actual rigors, alternating with flushes of heat, dryness of the skin, aching in the eyeballs, and intense aching pains along the spine and in the limbs, but more particularly in the joints, which become red and swollen. The pulse becomes hard and rapid and the respirations are accelerated. There is a sensation of heat and pain at the epigastrium associated with furred tongue, loss of appetite, and very frequently nausea, intense muscular prostration, restlessness, and insomnia and slight delirium. The face is suffused and puffed, the eyes are red, and the mucous membranes congested. The skin is covered with an erythematous rash. Prostration steadily increases, the temperature rises gradually, reaching, not infrequently, 106° or 107° F.; the pulse rises to 120 or even 140; the tongue becomes coated, except at the tip, with a thick, white, moist fur; the pains become increased in severity, and tend to shift about as in ordinary rheumatism; and the affected joints become more swollen. By the third or fourth day the fever has reached its maximum, profuse perspirations appear, the severity of the symptoms somewhat abate, and the patient feels prostrated and stiff. In a couple of

days, or longer, a second paroxysm of fever appears; the pain returns; and an evanescent eruption, in many cases, appears, first on the hands and feet and later spreading all over the body. This polymorphous eruption is sometimes macular, like that of measles; sometimes diffuse, like scarlatina; it may resemble the eruption of urticaria or of lichen, or it may be vesicular in character. This eruption usually disappears on the second day, is attended with more or less itching, and is followed by desquamation. With the disappearance of the rash, on about the seventh or eighth day of the disease, the fever declines, the symptoms abate, and the patient becomes convalescent. In a short time, however, a relapse occurs, during which the symptoms are almost as severe as those of the primary attack, which lasts for two or three days; a second or third relapse may follow intervals of apparent convalescence. After the final cessation of the febrile attacks great debility, and, often, pain, stiffness, and swelling of the joints remain; and permanent convalescence is not finally established until the lapse of three months.

Other occasional symptoms have been noted: hyperæmia and inflammation of the mucous membranes of the mouth and respiratory tract; epistaxis; swelling of the parotids, with salivation; swelling of the lymphatic glands or of the testicles (which may persist for weeks after the fever has abated); jaundice, and ophthalmia. In some cases the appetite continues good throughout. Patients that are pregnant rarely abort. Complications are rare. Convulsions sometimes have been observed in children. Hæmorrhage from the mucous membranes was noted by Rush. Black vomit has been observed by some writers.

DIAGNOSIS.—The symptoms of dengue resemble somewhat those of ague, scarlet

fever, measles, and yellow and relapsing fevers. As the disease presents a distinct remission and is usually epidemic, the diagnosis from rheumatism is rarely difficult. The greatest difficulty, perhaps, is the differentiation of dengue from yellow fever, as they frequently co-exist in the Southern States and the tropics. Guitéras lays stress on three diagnostic points which he claims are pathognomonic of yellow fever: the facies, the albuminuria, and the slowing of the pulse, with maintenance or elevation of the fever. He also states that jaundice, which sometimes occurs in dengue, rarely appears as early as the second or third day of the disease, and on this much stress should be laid. Hæmorrhages are much less common in dengue, although they do occur, as recognized by Rush and others. The eruption of dengue and the intensity of the arthritic inflammation may serve to distinguish it from relapsing fever.

The disease prevalent in the southern camps during the Spanish War, often diagnosed as malaria, was really dengue fever. As soon as the rains began (July 5), the fever began to spread rapidly, taking men in such order as to rule out the idea of contagion. It was an infectious disease, with an incubation-period of a day or so. It began suddenly with chills and intense occipital headache; pains in the bones and muscles; high fever (105° to 106° F.); mild delirium, insomnia, restlessness, and nightmares; occasionally there were petechiæ and blotchings of the skin. These for three or four days, then a rapid decline of the fever. After a few days more, sometimes symptoms of catarrhal jaundice would appear. The acute symptoms were over in a week, leaving the patients much prostrated and unnerved. The disease was never fatal. The rapid decline of the fever, the absence of the usual intestinal symptoms; of the usual characteristic stools, spots, and facies; the tendency of the disease to recur—all precluded the

idea of typhoid in typical cases. There were undoubtedly cases of mixed infection, the typhoid appearing later. The fever was undoubtedly the dengue. W. T. B. Harland (Phila. Med. Jour., June 24, '99).

ETIOLOGY. — McLaughlin, of Texas, has found a micrococcus in the blood of patients suffering with dengue which he believes to be the specific cause of the disease. The infection of this disease is more virulent and spreads more rapidly, if possible, than that of influenza; it attacks alike male and female, young and old, all classes indiscriminately. During the epidemic in Galveston in 1897, 20,000 people were attacked within two months. It prevails generally in the summer season, is favored by faulty hygienic conditions, and spreads along the lines of travel by land and sea. It is believed by many to be contagious.

Mosquitoes are the carriers of the infection from person to person. In Beyrouth those individuals that were bitten by infected mosquitoes invariably got the disease; the others that were protected from their bites remained well. A careful examination of the blood in over 100 cases showed each time the presence of amœboid organisms in the red cells. These organisms closely resembled the plasmodium of malaria, the only difference being that the cycle of reproduction or formation in the human blood is longer in dengue than in malaria, and the changes in their life-phases are slower and more difficult to follow. Flagellate bodies were also encountered. The constant presence of this hæmatozoön in the red cells during the fever, its resemblance to the parasite of Texas cattle-fever, its likeness in manner of growth and mode of propagation by the mosquito to the malarial parasite, all speak in favor of the author's view that this parasite is the cause of dengue. Among the mosquitoes were found certain forms of *Culex* which showed themselves capable of carrying the disease to man. Graham (Medical Record, Feb. 8, 1902).

PATHOLOGY. — The lesions of this disease are practically unknown.

PROGNOSIS. — Dengue is rarely fatal. Notwithstanding the high fever, the severe pain, and the general gravity of the symptoms, those suffering from this disease rarely have delirium or fail to recover ultimately. Occasionally early in the disease, during the defervescence, death occurs from syncope. S. H. Dickson reported three deaths in the Charleston epidemic (1828).

TREATMENT. — The treatment of the disease is symptomatic. Quinine has been used as a prophylactic, but, according to Osler, on insufficient grounds. Salines, refrigerants, and hydrotherapy (cold pack or bath) may be employed against the fever. The headache and arthritic pains may sometimes be relieved by local applications and the use of the salicylates, phenacetin, or acetanilid; more often opium in some form is required. Later, when convalescence is established and the arthritic pains persist, great relief may follow the use of the iodides; quinine and other tonics are indicated throughout the period of convalescence.

Beyond general hygienic measures, such as rest in bed, a fluid diet, mild aperients, etc., there appears to be but little in the treatment of dengue. Exposure greatly increases the severity of the pains. All exertion, both physical and mental, is to be avoided.

Antipyrine relieves the headache in a remarkable manner, and also the other pains in a lesser degree. Antifebrin, phenacetin, and antikamnia act similarly, though more feebly. It is advisable to avoid large doses of antipyrine; for adults, 10 grains may be given whenever the symptoms are severe, but never more frequently than once in eight hours. The drug, however, should be avoided late on the fourth day, as if given shortly before the crisis collapse might thereby be in-

creased. Sulphonal has seemed to act well as an hypnotic.

Morphine subcutaneously is at times demanded by the severity of the pains, but it is apt to be followed by an exacerbation of the gastric symptoms.

For the retching and vomiting, which is so constant a symptom on the fourth and fifth days, nothing has been found effectual except emetics of warm water. The patient is directed to swallow rapidly a pint or more of warm water. This is immediately returned and the procedure repeated once or twice.

It is of the greatest importance to warn parents of the possibility of collapse, and to instruct them carefully in the management of this condition before it arises. It almost always occurs at the same period of the disease, viz.: about the end of the fourth day or the beginning of the fifth. The child should then be constantly watched, not being left for an instant, and the proper remedial measures taken on the first suspicion of a change. Hot stimulants are to be given by the mouth if possible, otherwise by the rectum, with beef-tea; external heat in all forms; mustard to the præcordia; hypodermic injections of strychnine and ether have generally been used. Wet packs or the bath have been tried in the hyperpyrexia which follows, but without benefit. F. E. Hare (*Australasian Med. Gaz.*, Mar. 21, '98).

Mountain-fever. — Osler observes that several distinct diseases have been described as mountain-fever: Mountain-anæmia, associated with anchylostoma, not yet met with in this country; certain cases of a fever occurring in mountainous regions of the Western States, which have been shown to be unmistakably typhoid fever, through the careful observations of Hoff, Smart, Woodruff, and Raymond, not only from the clinical features, but the Widal reaction as well. It would be well, says Osler, for the use of the term mountain-fever to be discontinued.

Mountain-fever is merely an atypical form of typhoid fever. The disease is characterized by malaise, headache, chill,

and pains in the muscles and back. The tongue is coated, there is loss of appetite, and constipation. The characteristic roseolar eruption is frequently present, and there is often gurgling in the right iliac fossa. The temperature is that characteristic of typhoid fever, but occasionally there are irregularities during the convalescent stage. The pulse is usually rapid, dicrotic, and occasionally intermittent. Intestinal hæmorrhage is exceedingly rare. Stuver (*Med. News*, Nov. 4, '99).

Cavite fever, according to B. L. Wright (*Phila. Med. Jour.*, Feb. 9, 1901), is an acute infectious disease, characterized by an abrupt onset, high temperature, severe muscular pain, and extremely tender and painful eyeballs. The predisposing causes are high temperatures; low, damp localities; overcrowding; and, possibly, the close proximity of salt-water. The period of incubation is two days to two weeks. The disease is of sudden onset, usually commencing with a slight chill; in a few hours the temperature rises to 104° or 105° F., and may even reach 107° F.

The face is flushed; the eyes injected, extremely painful, and tender; the skin burning hot; the pulse full, strong, and rapid; the respiration accelerated, and the mind frequently delirious; the patient extremely prostrated.

Nausea and vomiting are usually present, the bowels constipated, and the urine scanty and high colored. Headache and muscular pain are severe; the latter usually located in the muscles of the back and legs, but occasionally in those of the arms and shoulders. The temperature usually continues high for from three to five days, when it falls by crisis; the muscular pain may or may not cease with the fall of temperature.

Relapses are not common; but second, third, and even more attacks are not unusual.

This disease is most apt to be confounded with dengue; but the absence of an afebrile period, and the rash, followed by a second febrile attack of definite duration, enable one to distinguish it from that disease. The absence of catarrhal symptoms separates it from catarrhus epidemicus.

The treatment should be as follows: Rest in bed, with a liquid diet. The bowels should be freely opened by a brisk saline purge, and kept regular by small and frequently repeated doses of calomel. Such drugs as antipyrine, phenacetin, or acetanilid, and small doses of quinine should be administered.

A good combination, which also includes the proper amount of calomel, is as follows:—

R Antipyrine, 3.8 grammes.

Quinine sulphate, 1.2 grammes.

Hydrarg. chlor. mit., 0.1 gramme.

M. et ft. cap. No. xij.

Sig.: One capsule every two or three hours.

The high temperature should be controlled by sponge-baths or by "tubbing," and an ice-cap should be applied to the head. For a week or ten days after recovery, tonics—such as iron, quinine, and strychnine—should be given.

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SPINAL CORD, DISEASES OF.

General Considerations.—The diseases of the spinal cord, including the various congenital and acquired deformities and anomalies of development, together with the primary or complicating affections of the meninges, are more than fifty in number. Of this list, however, more than half represent rare and sometimes exquisitely refined distinctions in type both clinically and pathologically, that are rela-

tively unimportant to the general practitioner. Of the diseases that are common there are less than a dozen. Infantile spinal paralysis, myelitis, and locomotor ataxia constitute collectively probably three-fifths of the entire number.

Numerous attempts have been made to classify the diseases of the cord, but so far such attempts have been largely sterile in practical results. Our knowledge of the anatomy and localization of function as well as of the pathology of the cord is constantly undergoing modification, necessitating changes in opinion and in teaching. The old division into systemic and non-systemic affections still obtains, but its limitations are constantly relaxing and its advantages becoming more and more problematical. Function is undoubtedly systemized, but contiguity as well as continuity is a factor in disease in the cord as elsewhere. The terms acute and chronic, inflammatory and degenerative, no longer represent clear-cut types, but are more likely to simply distinguish stages of progress in what is often the same affection. Sclerosis as distinguished from gliosis is probably—almost positively—not a primary condition, but may attend secondarily any acute lesion of the cord. It is equally true, however, that certain spinal-cord affections are inherently degenerative in tendency *ab initio*, the acute stage, if there be such, being clinically indefinable. In view of these facts I shall make no attempt to classify the diseases to be considered, an omission the more legitimate here since many of the diseases properly belonging in this article have been treated elsewhere. LOCOMOTOR ATAXIA has been, on account of its importance, described in a separate article; so also has multiple sclerosis and the forms of meningitis. Abscess of the cord is best studied in connection with

caries of the vertebra, with which it is often associated. The vascular diseases of the cord—hæmorrhage, embolus, thrombus, and aneurism—are exceedingly rare, and this is true also of tumors, though perhaps less so. The spinal type of progressive muscular atrophy has been included among the diseases of the muscles. (See also CHRONIC POLIOMYELITIS.)

It is impossible to overestimate the essential importance of a knowledge, more or less complete, of the anatomy and physiology of the cord. The facts and theories of localization should also be familiar. The limits of this article, however, do not permit an elaborate consideration of this aspect of the subject.

The numbers opposite the names of the following diseases of the spinal cord represent the chief anatomical location of the morbid process in each disease:—

Poliomyelitis, 2.

Primary lateral sclerosis, 5 and 4.

Amyotrophic lateral sclerosis, 2, 5, and 4.

Locomotor ataxia, 8, 9, 10, 6, 7, 11, and 3.

Syringomyelia, 1 and any one or several others.

Ataxic paraplegia, 5, 7, 8, 9, and 10.
Progressive muscular spinal atrophy, 2.
Transverse myelitis complete, 1 to 11, inclusive.

Friedreich's ataxia, 4, 5, 7, 8, 9, 10, and sometimes 6.

Myelitis.

Synonyms.—Inflammation of the spinal cord; softening of the spinal cord.

Definition.—Myelitis is an inflammation, localized or general, with secondary softening or sclerosis of the spinal cord, with irritative and paralytic motor and sensory as well as special symptoms, varying in character and distribution with the localization and degree of the morbid process at different levels or areas of the cord. Many varieties are recognized. The anatomical division includes the cervical, dorsal, and lumbar varieties; the transverse (imperfect or complete); the diffuse, or disseminated; the focal; the central; and the marginal. The last mentioned is frequently associated with and often dependent upon a meningitis, the resultant condition being known as meningomyelitis. The etiological division includes at least three varieties of importance: the traumatic, the syphilitic,

NAME.	FUNCTION.	SYMPTOMS IN DISEASE OF.
1. Central canal.	Motor. Trophic. Sensory.	Atrophy. Paralysis. Anæsthesia. Analgesia. Loss of temperature.
2. Anterior horns.	Motor. Trophic. Reflex.	Flaccid paralysis. Atrophy. Lost reflexes.
3. Posterior horns.	Sensory.	Loss or impairment of all forms of sensation.
4. Anterior columns (Türk's).	Motor. Inhibitory.	Spastic paralysis. Contractures. Exaggerated reflexes.
5. Crossed (lateral) pyramidal columns.	Motor. Inhibitory.	Spastic paralysis. Contractures. Exaggerated reflexes.
6. Gowers's columns.	Sensory (pain and temperature?).	Hyperalgesia or analgesia. Loss of temperature sense.
7. Direct cerebellar columns.	Sensory (muscular?).	Ataxia.
8. Spitzka-Lissauer columns.	Sensory (tactile?).	Hyperæsthesia or anæsthesia. Trophic symptoms (?).
9. Burdach's columns.	Sensory (tactile pain; excito-reflex?).	Hyperæsthesia or anæsthesia and algesia. Lost reflex.
10. Goll's columns.	Sensory (muscular tact; pain?).	Ataxia. Hyperæsthesia or anæsthesia and algesia. Lost reflex.
11. Clarke's columns.	Sensory (same as Goll's?).	Ataxia. Hyperæsthesia or anæsthesia and algesia. Lost reflex.

and the tubercular. The terms acute, subacute, and chronic appear in the literature, although Strümpell and others dispute the existence of a primary chronic myelitis. The type of all forms is acute transverse myelitis.

Symptoms.—The disease may begin abruptly, subacutely, or very gradually. When the onset is abrupt a chill more or less severe may mark the introduction, followed by fever, the temperature ranging from 101° to 104°, occasionally higher. In children the onset may be attended with convulsions; aside from the general malaise and fever, the constitutional disturbance may be slight. The essential nervous symptoms are usually irritative at first, although motor and sensory paralysis may be present from the start. These nervous symptoms vary widely with the locality and extent of the myelitic process. This variation in the symptom-picture, according to the locality affected, imperatively necessitates a certain degree of familiarity with the topographical anatomy and functional localization of the cord. The dorsal region is most frequently affected in the focal disease. Among the irritative symptoms hyperalgesia and hyperæsthesia are common. The patient may complain, sometimes emphatically, of pain in the back and legs. Quite often the sensation is that of a tired aching in the limbs, as from excessive fatigue. If up and walking about, the legs are lifted wearily and the patient refers to them as being weighted with lead. There is a subjective numbness, or various paræsthesiæ may be mentioned. The bladder is disturbed in function. There is retention, or the urine may dribble involuntarily. The bowels are usually obstinately constipated; less frequently there is incontinence of fæces. Sexual power is lost or there may be persistent pri-

apism. A feeling as of a band or belt encircling the hips, the waist, or the chest may be present. This is the so-called *ceinture*, or girdle symptom, and is quite constant in myelitis. The level of the *ceinture* feeling is a guide to the level of the cord-lesion. If the disease is of the cervical cord, involving the origin of the brachial plexus, the arms will be affected. Pupillary changes are also frequently noted when the disease is of the cervical cord through implication of Budge's cilio-spinal centre. Should the myelitis extend upward the functions of the vagus are disturbed and dyspnœa, with circulatory and vasomotor symptoms, is added to the picture. Following the irritative come the paralytic symptoms. The hyperæsthesia is succeeded by anæsthesia, which is characteristically erratic in distribution, due to the destruction of some fibres and the escape of others. Any or all other forms of common sensation may be impaired or completely lost. There may be dissociation of sensation, though this symptom is not common. The motor weakness is succeeded by actual paralysis, which follows an anatomical distribution, but is usually not absolute. This paralysis may be flaccid or spastic, or first one and later the other, with abolished or exaggerated reflexes according to the location of the lesion. Wide-spread motor and sensory paralysis may follow slowly a prolonged irritative stage or it may be extensive and complete within a few hours or days after the onset of the disease. Within a few weeks or months atrophy of the muscle, sometimes slight, sometimes extreme, occurs. The electrical reactions may remain normal, although both quantitative and qualitative changes have been frequently noted. Bed-sores are exceedingly common in severe cases, and are sometimes an extremely vicious and dan-

gerous symptom. In the spastic cases decided contractures may develop, the knees being flexed upon the abdomen, the heels touching the buttocks. Clonic or tonic spasms occurring in exquisitely painful paroxysms add to the sufferings of the patient in many instances. In the chronic variety of the disease the irritative symptoms are far less prominent. The mind remains unaffected in all cases except where an insanity may be superadded from pain and abject helplessness. It should be remembered, too, that the syphilis or tuberculosis or alcohol causing a myelitis may later attack the brain.

Diagnosis.—The acute disease may occasionally closely resemble Landry's paralysis. In the latter affection the sensory symptoms are slight, usually there are no bladder or rectal symptoms, no girdle sensation, and the course of the disease is, as a rule, much more rapid. Spinal meningitis rarely exists alone, the cerebral meninges being usually simultaneously involved. In syphilitic or tubercular spinal pachymeningitis or leptomeningitis, the pain is usually much more conspicuous and the irritative spasms more decided. Usually, however, in both pachymeningitis and leptomeningitis due to these causes the cord itself is soon involved, and the differentiation is unimportant. Occasionally the symptom-picture in myelitis may suggest locomotor ataxia. The knee-jerks may be abolished or greatly diminished, the genital functions are involved, the sensory symptoms may be similar, Romberg's symptom may be present, and there may be an ataxic gait. The Argyll-Robertson pupil will be found wanting, however, as well as other ocular and optic-nerve changes; the pains are different in character and degree, and there is true motor paralysis in myelitis not present in tabes dorsalis. The history as regards mode of onset and rate

of progress is of value in differentiating spinal muscular atrophy and amyotrophic lateral sclerosis and primary lateral sclerosis from myelitis. Tumor of the cord is almost invariably complicated with myelitis of focal type, and the symptoms are necessarily identical in great measure. It is possible, however, to determine the existence of tumor at times by the more intense and sometimes agonizing pain, the slower rate of progress, the narrower limitation of symptoms, and the lessened degree of constitutional disturbance. The presence of tumor elsewhere, especially if malignant, is often of assistance. Spinal hæmorrhage, if at all extensive, is usually quickly fatal from shock.

Etiology.—The disease may occur at any age and in either sex, though it is most common in males between the ages of fifteen and forty years. Prolonged or severe exposure to cold and dampness is a frequent and potent etiological factor. Next in frequency and importance, perhaps, is trauma, including excessive physical effort or exertion. A relatively large number of cases are due to syphilis, which may act either directly and immediately or indirectly and remotely as the cause. Tuberculous myelitis is rare, though spinal meningitis due to tuberculosis with secondary complicating invasion of the cord is not uncommon. Occasionally myelitis occurs during or immediately following (*propter hoc*) the acute infectious diseases. Arsenic, lead, and other metallic poisons may induce the disease. Gross alcoholic excess is often a most important contributing factor and may occasionally prove the sole cause, although the brain and peripheral nerves are usually affected equally and simultaneously in such instances. In a very appreciable proportion of patients the etiology cannot be positively determined. This is espe-

cially true in subacute and chronic myelitis.

Pathology.—The morbid anatomy of myelitis varies with the cause of the disease somewhat and to a still greater degree with the stage during which death occurs. In patients dying during the acute stages the appearance of the cord in the areas affected is that of an acute inflammatory process. The blood-vessels are engorged and increased in number. Minute punctiform or capillary hæmorrhages are sometimes present. The cells are swollen and the nuclei distorted or displaced. These changes are followed by an increase of connective tissue, with destruction of the nerve-cells and nerve-fibres. The cord may be discolored and swollen in appearance on gross inspection or it may appear shrunken. Later the vessel-walls become thickened; the nerve-tissue is more or less completely displaced by connective tissue; the cells disappear and are replaced by granular and amorphous material. The pia and even the dura may be involved. In some instances, especially those due to syphilis, the entire cord for several inches may be so softened as to be diffuent. The nerves may participate secondarily in the degenerative process.

Prognosis.—This varies widely in individual instances, the variation being dependent chiefly upon the etiology, although the severity of symptoms is also a factor. Myelitis due to causes which are removable by surgical procedure—as, for example, compression from trauma, tumor, or vertebral disease—may occasionally be completely cured. Syphilitic myelitis offers a distinctly better prognosis than the non-syphilitic, although even here an opinion as to the outcome should always be extremely guarded and never positive at first, especially as regards permanent disability. Immediate

danger as regards life is greatest in myelitis due to or following the infectious fevers, sepsis, and severe injury. The duration of the disease is equally indefinite; a subacute myelitis may pass into a chronic, slowly progressive form, the gradual development of symptoms extending over a period of many months or years. The inflammation may subside after a varying length of time and be followed by a necrosis or sclerosis which is limited by the preceding inflammation, the patient being left with a paralysis which remains permanently stationary. The process may stop and remain stationary for some time and then start up again, some slight additional cause relighting the fire in a locality predisposed by previous disease. The severity of the trophic symptoms is quite reliable as a guide in determining the immediate danger to life, deep and extensive bed-sores being invariably of ill omen. Severe bladder symptoms are also of evil significance.

Treatment.—Absolute rest in bed is essential in all cases; at first counter-irritation should be employed, with extreme caution, however, on account of the danger of inducing bed-sores. A water-bed is often advisable from the first to prevent this complication. The catheter should be employed also with extreme antiseptic and mechanical precaution. Pain should be relieved by opiates when necessary, but in minimum doses. The details of treatment vary with the cause. In syphilitic myelitis no time should be lost; the patient should be put at once upon full and rapidly increasing doses of potassium iodide. The dose to begin should be at least 25 drops of the saturated solution. The salt should be pure and the vehicle should be changed every few days—water, milk, Vichy, Apollinaris, Geissshübler water, or plain carbonated

water may be employed in turn. The dose should be progressively diluted more and more, as it is increased. Should iodism develop, double the dose if less than 40 drops or grains; if over 100, reduce it one-half and rapidly increase to a dose beyond that at which iodism occurred. The maximum daily amount is to be determined by the effect on the disease, but it is rarely necessary to give more than 600 or 800 grains daily. Mercury is superior to the iodide only when primary syphilis has immediately or at least recently preceded the myelitis. When the disease results from trauma or is due to tumor, abscess, or disease of the vertebra, the question of operative interference should always be considered and decided promptly in order to prevent extension and secondary softening. Symptomatic relief may often be obtained by appropriate operative procedure, and this is true even in tuberculous myelitis, where lumbar puncture with drainage at times greatly alleviates the patient's distress. In myelitis due to infection there is no specific drug or plan of treatment. Sodii salicylatis, small doses of mercury, or full doses of iron may be given in addition to the familiar local measures during the acute stage.

For the chronic disease we may expect a certain amount of benefit from galvanism and massage. The details of the electrical treatment will vary with the locality affected (see POLIOMYELITIS). Silver, arsenic, gold, phosphorus, and ergot are all mentioned as therapeutic resources, but there is little, if any, evidence of specific benefit from either. A tentative course of treatment with potassium iodide should be given in all chronic cases.

Poliomyelitis.

Synonyms. — Infantile spinal paralysis; myelitis of the anterior horns; acute

atrophic paralysis; essential paralysis of children; West's morning paralysis.

Definition.—A purely motor paralysis of flaccid type, occurring usually in young children, the paralysis being followed by rapidly developing atrophy, with degenerative electrical reactions in the affected muscles. An *acute*, a *subacute*, and a *chronic* form are recognized, the last being the variety commonly observed in adults.

Symptoms. — An attack of acute infantile spinal paralysis is, as a rule, unattended with prodromata. The disease begins abruptly, usually with some fever, the essential significance of which is rarely understood at this stage. The temperature may be only slightly elevated (1 to 3 degrees), the range being higher and the fever more prolonged, the older the child. There may be slight digestive disorders,—such as vomiting and diarrhoea,—slight headache, and in some instances the patient may complain of pain in the back and limbs. These general symptoms vary in intensity with the temperature. In about one-fourth of all cases the onset of the disease may be marked by a convulsive seizure. The younger the patient and the higher the temperature, the more likelihood is there of convulsions, which, however, are rarely repeated more than once or twice. After a few days—usually two or three, rarely more than ten—the fever and general disturbance subside, and not until then, usually, is the true nature of the illness made evident by the discovery of a flaccid motor paralysis, which may at first affect all of the extremities as well as the trunk-muscles. If suspected and sought for, however, the paralysis may often be detected during the febrile stage. Within a week or two the general paralysis clears away, leaving a residual paralysis limited to one or more limbs, or, it may be, to a single

muscle or group of muscles. Such groups are invariably of muscles of associated function. The lower limbs are rather more frequently affected than the arms. A paraplegic distribution is common, a hemiplegic distribution exceedingly rare.

In perhaps one-fourth of all cases among children the onset is even more abrupt than as described. The child may be put to bed in apparent good health, sleep quietly or perhaps a little restlessly through the night, and is found the following morning bright, cheerful, and with a hearty appetite, but paralyzed in one limb, or, it may be, with a paraplegia, the affected limb hanging helpless and inert. Such cases were described in the older literature as West's morning paralysis.

There is no sensory disturbance in poliomyelitis, or, if present at all, it amounts only to a slight tenderness on pressure or manipulation. The hyperæsthesia of meningitis is extremely uncommon, and suggests a complication. The bladder and rectum are not involved, the cranial nerves remain normal, nor is intelligence at all affected. Within two weeks usually, sometimes much earlier, the muscles paralyzed begin to atrophy. The wasting sometimes progresses rapidly. If the child is fat, this atrophy may not be apparent to the eye, but palpation will at once make it evident. Not only does the limb look wasted, but it usually presents a bluish, cyanosed appearance, and to the touch of the examiner it is distinctly colder than its fellow. The deep reflexes are lost, if affected at all. Care and familiarity with the subject are both needed to avoid misleading conclusions in eliciting this symptom. Simultaneously with the atrophy, or it may be a little later, an alteration both quantitative and qualitative may be noted in the response to both the faradic and galvanic

currents. To the faradic current the muscular response is at first simply diminished. It grows more and more feeble from day to day, and is eventually lost completely in severe cases. To the galvanic current the nerves involved show at first beginning and later more or less complete reaction of degeneration. In making these electrical tests the corresponding sound muscles in the unaffected limb should be examined and the response compared with that obtained from the paralyzed muscles. Minor changes can only be determined in this way. Within a few months various deformities from contraction and unopposed muscular antagonism may develop. Talipes varus and equinus and many other deformities are possible. Sometimes an arrest of development occurs, one limb after a few years being shorter than the other or one hand or foot smaller than the other. Chronic poliomyelitis is one of the forms of progressive muscular atrophy and, together with the subacute variety, differs chiefly in the mode of onset and rate of progress, but not in the essential nature of the established paralysis.

Diagnosis.—Although less than 5 per cent. of the cases are correctly interpreted during the acute or febrile stage, the history of this stage is of importance in the differential diagnosis, especially in excluding cerebral meningitis and the cerebral palsies of childhood. In poliomyelitis there are few irritative symptoms such as pain and spasm. One or two convulsions may occur, but the habit is not established and the patient does not develop epilepsy or mental enfeeblement. Epilepsy, on the other hand, is often a part of the symptom-picture in the cerebral palsies and mental impairment in some degree almost invariably present. The type of the paralysis in the two is

exactly opposite. In poliomyelitis the paralysis is flaccid, the reflexes are lost, the muscles atrophy, the muscles affected are functionally associated, and a monoplegia is the rule as regards distribution. In the cerebral palsies the paralysis is spastic in type, with exaggerated reflexes; no wasting, although arrest of development may result; the paralysis is of muscles anatomically associated; the distribution is usually hemiplegic, monoplegias being rare. In cerebral palsies, too, the cranial nerves, particularly the facial, are often affected and the mind is almost invariably impaired, which is never true of infantile spinal paralysis. Finally, there are no electrical changes characteristic of the cerebral palsies. From other forms of myelitis infantile spinal paralysis is to be distinguished chiefly by the absence in the latter affection of sensory symptoms, of sphincter involvement, of bed-sores, of spastic or semispastic phenomena. Palsies from peripheral neuritis due to trauma, including so-called birth-palsies caused by obstetrical forceps or injury in delivery, are often difficult to distinguish from poliomyelitis. The history of injury to the arm or shoulder and the anatomical distribution of the paralysis are points of differential value. In neuritis of this type sensory disturbances are not conspicuous, as a rule, but may be present. The history as to mode of onset and progress serves to distinguish poliomyelitis anterior acuta from the pure muscular atrophies.

Etiology.—Ninety per cent. of the acute cases occur within the first decade of life and more than half of all cases within the first three years of life. Among children the two sexes seem about equally susceptible. Among adults it is comparatively rare in the female. The disease is no respecter of cast or class, nor does it manifest any special

racial proclivities, though the negro is comparatively exempt and the disease is more common in centres of dense population than in rural districts. Poliomyelitis is often a sequel to the febrile infections of childhood, especially scarlet fever, measles, and diphtheria. In this respect, as well as others, its etiology is quite similar to that of epidemic and sporadic cerebro-spinal meningitis. Poliomyelitis may also occur as an epidemic, many such having been reported, though no specific micro-organism has as yet been demonstrated.

Poliomyelitis anterior acuta is believed to be of an infectious or an infectio-toxic nature. This view is based on the numerous experiments in which the disease has been produced in animals by the injection of different bacteria and their toxins. There is, perhaps, a secondary inflammation due to a primary focus situated in the intestine or elsewhere. Bülow-Hansen and F. Harbitz (Norsk Mag. for Laeg., Nov., '98).

Study of 208 cases of poliomyelitis observed over a space of twelve years in the polyclinic of Vienna further sustains the theory of the infectious origin of poliomyelitis, first pointed out by Strümpell and Marie. This is now generally admitted, and one of the strong arguments in favor of this view is the *seriatim*, or epidemic, appearance of the disease. These 208 cases show that from 1886 to 1897 the number of cases ranged between 3 and 18; in 1898 this average arose to 42, to fall to 6 in 1899. Moreover, of the 129 cases observed between 1886 and 1897, there were 35 which began between the months of January and July, and from July to January there were 75, while in 19 cases the date of onset was not ascertainable. Even if all the uncertain cases were to be ascribed to the earlier half of the year the number occurring from July to January would still be notably the larger. The preponderance of cases in the summer months thus seems quite evident. In the epidemic of 1898 four cases developed from January to July;

in July, 5 cases; in August, 11 cases; in September, 12 cases; in October, 4 cases; in November, 3 cases; and in December, 1 case. Among these cases and also among those of preceding years there was not one instance of family infection, nor were the cases confined to one street, or house, or to a certain section of the city. It therefore seems certain that, if infantile palsy is an infectious disease, its power of contagion is very limited, in which respect it resembles cerebro-spinal meningitis. Zappert (Jahrb. f. Kinderh., B. 3, S. 125, 1901).

In not a few instances trauma appears as the exciting cause; exposure to extreme cold or to excessive or violent exercise may induce the disease. The season has its influence, many more cases occurring in summer than in winter. This is especially noticeable in seasons of prolonged excessive heat. Among adults violent exercise, exposure, trauma, debilitating excesses, and syphilis are recognized as potent factors. Heredity is extremely rare.

Pathology.—The essential lesion in acute anterior poliomyelitis is an atrophic destruction, more or less complete, of the larger ganglion-cells (giant cells) of the anterior horns. This destruction of the cells of the anterior horns occurs as the result of an inflammatory myelitic process limited to the anterior gray matter, established through some, as yet undetermined, micro-organism in many instances, but probably not in all, the medium of invasion being the branches of the anterior spinal artery. The cells of the lower dorsal and midcervical segments are most frequently affected. The anterior nerve-roots are also affected secondarily with degenerative changes, and this is true of the muscles to which the affected nerves are distributed. The atrophied muscles show a distinct diminution in the size and number of fibres,

the normal tissue being replaced by fat and connective tissue.

Prognosis.—It is of some interest to know or to approximate during the acute febrile stage the extent or degree and the distribution of the final more or less permanent paralysis. There is no positive guide, but the severity of the constitutional disturbance, including temperature, is sometimes an index. Occasionally after the constitutional disturbance subsides, the loss of power may remain rather widely distributed. In such instances the electrical response affords information to the experienced examiner. If the quantitative response grows less or the qualitative change greater from day to day in certain muscles or a limb, just in proportion is there likely to be a permanent residual paralysis in such muscles or limb or *vice versâ*. In all cases some permanent paralysis will remain, but it may be six months from the onset before the limits of this paralysis can be determined. The patient is handicapped physically in after-life to a greater or less extent, but never mentally. The prognosis depends largely upon the ability of the parent to carry out instructions in faithful, patient, persistent treatment.

Treatment.—During the febrile stage the treatment is that for all forms of acute myelitis, including absolute quiet and rest, ice-bags or counter-irritation to the spine, laxatives, and a non-stimulating, easily digested diet. To these measures should be added, if there is much fever, antipyretics, such as phenacetin or other coal-tar derivatives. It is customary to use ergot in $\frac{1}{2}$ -drachm doses or less, with or without bromide of potassium, and no harm is likely to follow its employment. The salicylate of soda has been employed with some advantage in epidemics of the disease, and its use

seems rational. Usually this stage is treated symptomatically, for the reason that a diagnosis is rarely made so early. For the permanent residual paralysis our most reliable therapeutic resources consist of electricity, massage, and exercise of the parts through the assistance of various mechanical appliances to be appropriately devised by the orthopædist. Both currents should be employed. In using galvanism one electrode, a large flat pad, should be placed over the spine at the level affected, the other on the limb paralyzed. Not more than 3 to 5 milliampères should be used at first. As the child becomes accustomed to it, the current-strength may be gradually increased. The *séance* should last twenty minutes daily, and should be followed by an application of the faradic current to the limb itself. The current here should be strong enough to produce gentle contractions. If there is no response to faradism except with painfully strong currents, the interrupted galvanic current may be used in the same way. As much as possible of the affected muscle should be included in the circuit.

Massage should be given, preferably by one qualified for the work, though, if an expert be not available, simple rubbing is of at least some service in stimulating the circulation and local nutrition. Strychnine internally is at times of apparent value. The amount should vary with the age, of course, but much larger doses than are ordinarily prescribed are indicated. Such large doses may be quite safely reached by a gradual increase. Splints, braces, and other appliances serve a useful purpose in preventing crippling contractions and unsightly deformities. A flaccid leg may be supported by a brace so as to become useful in walking, which in itself is a valuable therapeutic aid. Velocipedes,

tricycles, and other similar machines are often of much service.

We should not turn away cases of infantile paralysis telling them that massage and electricity is all that can be done for them and recommending them to wear braces and shoes for the treatment of their deformities. In every case a special study of the muscles involved must be made, and living tendons transplanted to replace the paralyzed ones if possible. The operation should not be done until it is definitely settled which groups of muscles are affected. Regarding the amount of strength of the muscle to be grafted as compared with the work it will be called upon to do, much may be left to Nature and the gradual strengthening of the muscle to meet the demands made upon it. Grafting should preferably be done above the annular ligament, as this ligament will then hold the tendon in its place. A tendon may be carried by blunt dissection for quite a distance subfascially or subcutaneously. Beck tunneled the interosseous ligament in grafting a posterior muscle into an anterior one. The best method of joining the tendon is to pull the paralyzed tendon through a perforation in the normal tendon and apply sutures.

Tenotomy of a spastic muscle causes the spasm to disappear. When spastic paralysis involves the muscles of the pelvis and thigh, tenotomy of the adductors and of the internal and external hamstrings may be done. Two personal cases reported. The first was a five-year-old male child with spastic paraplegia involving all the muscles of both legs. He was unable to stand alone. The tendo Achillis on each side, both the adductor groups at the perineum, and both left and right, internal and external hamstrings were severed and the right quadriceps extensor tendon lengthened. The immediate result was much less spasm of the right leg and attempts at walking improved. The second case was a male, aged 22, suffering from spastic paralysis as a result of spinal injury. The adductors, both hamstrings, and the tensor vaginæ femoris of the right leg

were severed and the quadriceps extensor lengthened. The improvement in this leg was so great that the other leg was operated upon in the same manner. The patient is now able to walk one hundred and fifty feet. F. S. Coolidge (Phila. Med. Jour., from *Annals of Surg.*, May, 1901).

Amyotrophic Lateral Sclerosis.

Definition.—Amyotrophic lateral sclerosis is a disease characterized essentially by the two symptoms of spastic rigidity and muscular atrophy.

Symptoms.—The clinical history of the disease is quite constant. It begins very insidiously, and its progress is slow at first. Usually the earliest symptoms are referable to the disease in the anterior horns, and are similar in character to those which mark the beginning of progressive spinal muscular atrophy: wasting of the thenar and hypothenar muscles, of the interossei or of the muscles of the arms or legs, almost always symmetrically, with or without tremor, which is rarely fibrillary, however. The degree of wasting may at first be so slight as not to attract attention or it may be readily mistaken at this stage for some form of progressive muscular atrophy. Within a few weeks or months, or, it may be, simultaneously, a sense of unusual fatigue upon exertion, with muscular stiffness and increasing difficulty in walking or in using the arms, due to the developing spastic rigidity, is noted, and the patient seeks advice. On examination, in addition to the atrophy, which is often more perceptible to touch than to vision, the limbs will be found more or less rigid and resistant to passive motion, giving the examiner a sensation as of bending a lead pipe. The knee-jerks and other deep reflexes will be found markedly exaggerated, and often early in the disease, and always in the well-established disease, ankle-clonus and wrist-clonus are readily elicited. If the

bulbar nuclei are involved, there may be wasting of the muscles of the face, with alteration in the expression and impairment of function as regards speech, respiration, deglutition, and cardiac action. A symptom of importance is the altered electrical reaction to both the faradic and galvanic currents. The muscles respond more and more feebly to faradism the more advanced the disease. The qualitative changes with the galvanic current are present early, and it is not uncommon to find decided alteration of the normal polar formula, with reaction of degeneration within a few weeks or months. In the late stages of the disease the atrophic symptoms may dominate the picture, the rigidity disappears, the reflexes are lost, and the victim is reduced to a state of bedridden helplessness, but with unimpaired intelligence.

Diagnosis.—The diagnosis is a matter of no difficulty ordinarily. The picture is that of primary lateral sclerosis and progressive spinal muscular atrophy combined. From other forms of myelitis and sclerosis presenting one or both of these symptoms, this disease is distinguished by the absence of sensory symptoms and of sphincter involvement. It is true that sensory symptoms have been occasionally noted in this disease, but such instances represent complicated and atypical examples, and have a different pathology.

Etiology.—It is not at all a common affection, is seen oftenest during middle adult life, and affects males chiefly. The etiology is not definitely understood, although traumatism, exposure to extreme cold, and excessive physical exertion, if prolonged, are probable auxiliary factors etiologically.

Pathology.—The pathology, on the contrary, is unusually well defined and constant. In the spinal cord the lesions

are found in the anterior horns and in the lateral and anterior pyramidal columns. In the anterior horns the lesions are practically identical with those observed in chronic poliomyelitis. The so-called giant cells are either atrophied or destroyed altogether. In the motor tracts, both lateral and anterior, there is in all cases a well-marked sclerosis of these fibres, extending throughout their entire length, often into and beyond the pons and occasionally even to the subcortical motor fibres of the Rolandic area itself. If the ponto-bulbar region is involved in the disease process, the motor nuclei are affected with degenerative atrophy exactly as are the cells of the anterior cornua. The peripheral nerves also undergo degeneration, which is of the parenchymatous type. In the muscles the essential fibres are replaced by connective tissue and fat, the alteration in color and consistency being often readily apparent upon quite superficial infection.

Summary of the pathological examination of a case which was under the writer's observation for two years preceding her death. The duration of the disease was three years: (a) There was uniform disappearance of the ventral horn cells throughout the entire cord, the dorsal region being less extensively involved than the enlargements of the cord. (b) There was degeneration of a zone in the anterior fundamental columns skirting and encircling the ventral horns in the cervical and upper dorsal regions, also the anterior portion of the lateral limiting layers. (c) There was degeneration of a marginal strip of ventral periphery of the cord expanding dorsally against the ventral and lateral border of the crossed pyramidal tract and appearing with a comma-shaped head in the lumbar and sacral regions. (d) There was deformity of the ventral face of the cord in the cervical and upper dorsal region due to a coneave sinking-in of the periphery. (e) There was neuroglia proliferation in

the degenerative area of white matter and also in the anterior horns of the cord enlargements. (f) There was evidence that the neuroglia proliferation was of longer duration in the clavical region than elsewhere. The degeneration was denser in this region and had caused shrinking of the ventral face of the cord at the emergence of the roots. (g) There was atrophy of the anterior roots. (h) There was evidence of cell degeneration (chromatolysis, plasmolysis, and disintegration) in the hypoglossal nucleus and the nucleus ambiguus. (i) The pyramidal tracts were intact. Joseph Collins (Amer. Jour. Med. Sci., June, 1903).

Prognosis.—The prognosis is hopeless as regards cure so far as precedent is a guide. Early helplessness is the rule, and death occurs within a few years, though a fatal termination may be delayed by an induced or spontaneous remission or arrest of progress, rendering the disease stationary for many months.

Treatment.—In the absence of any plan of treatment known to be effective as a means of cure, our efforts are limited by experience to purely palliative measures. Among these, rest, massage, electricity, and hydrotherapy are all of value. The victims of this disease should be considered legitimate subjects for therapeutic experiment.

Primary Lateral Sclerosis.

Synonyms. — Spastic spinal paralysis; spastic paraplegia.

Definition.—It is a disease of gradual progressive onset assumed to be dependent upon a primary sclerotic affection of the lateral pyramidal tracts or columns, with symptoms of motor paralysis of spastic type, exaggerated reflexes, clonus, and contractures.

Symptoms.—Spastic spinal paralysis is always of gradual onset. It may begin as a stiffness in walking or in using the arms which gradually increases and suggests a condition of tonic spasm. The essen-

tial symptom in the developed disease is one of spastic contracture of the muscles of the extremities, particularly the flexors. The symptoms are most objectively conspicuous in the lower limbs, and in walking the gait is strikingly peculiar and almost pathognomonic, consisting of short, jerky, spasmodic, dragging steps, the patient being tilted forward on tip-toe. The act of walking will sometimes induce a clonus causing a series of heel-taps as the foot drags along the floor. Clonus is nearly always present in decided degree, and the deep reflexes—knee, wrist, ankle, elbow, and jaw—are invariably greatly exaggerated. There are no sensory or trophic symptoms, nor are the intracranial nerves or functions involved; but the bladder is often disturbed, the patient exhibiting what Seguin has termed “hasty micturition.” Sexual function may be indirectly lost.

Diagnosis.—The diagnosis is ordinarily a matter of no great difficulty, for, notwithstanding the vagueness of its pathology, the clinical picture is very constant and striking. Secondary lateral sclerosis from intracranial or basilar lesions is confusing only when such lesions are bilateral, and the presence in such cases of cranial-nerve involvement and of mental impairment will at once exclude the primary type. In myelitis with spastic contractures, the presence, in addition, of sensory symptoms, atrophy, rectal and vesical paralysis, with bed-sores and other trophic lesions, will readily differentiate. In disseminated sclerosis the patient may exhibit a typical spastic gait, with contractures and exaggerated reflexes, but the additional symptoms of intention tremor, nystagmus, scanning speech, oculomotor palsies, and sensory disturbances are peculiar, in their associated presence, to multiple sclerosis alone. In amyotrophic lateral sclerosis

the marked and early atrophy is a distinguishing symptom. In progressive spastic ataxia, or ataxic paraplegia, the inco-ordination is sufficient to exclude the disease under consideration. In all cases, in view of the exceedingly inconstant pathology, a diagnosis of primary lateral sclerosis should be entertained only after most rigid exclusion of every other possibility and particularly disseminated sclerosis in an anomalous or atypical form.

Etiology.—The disease affects adult males chiefly, and the decade between 25 and 35 is the period of onset in the majority of instances. It is not very common, and its etiology is not at all definitely known, but is probably related to that of ordinary chronic myelitis.

Pathology.—The pathological evidence in support of the assumption that a primary sclerosis of the lateral columns exists is so slight and indefinite as to have led to much skepticism and, indeed, to downright denial. The morbid changes found post-mortem have been strikingly inconstant. Tumor, hydro-myelus, pachymeningitis, transverse myelitis, syringomyelitis, hydrocephalus, and several times disseminated sclerosis are among the many lesions which have been observed.

Prognosis.—The disease may last many years, the general health remaining quite good. Recoveries are unknown. The victim of the disease is sooner or later incapacitated for any and all forms of physical labor, though he may be able to employ the hands and arms after walking shall have become impossible. The mind is not affected.

Treatment.—The treatment is largely limited to symptomatic relief, experience having proved that but little may be hoped from measures directed toward a cure. Prolonged rest is of the first im-

portance, and will at times result in decided amelioration of symptoms. The motor depressants—hyoscine, atropine, and conium—have all been successfully employed for the temporary relief of the spasticity. Hydrotherapy also serves effectually the same purpose.

Landry's Paralysis.

Synonym.—Acute ascending paralysis.

Definition.—Landry's paralysis is a rapidly progressive motor paralysis of flaccid type, beginning in the extremities, usually the legs, extending thence upward through the trunk to the arms, and frequently to the nerves which have their origin in the lower pons-medulla region. In some instances the disease may begin above and progressively descend.

Symptoms.—The disease begins with a feeling of extreme weakness, occasionally associated with paræsthesiæ, especially numbness, in the legs. This is progressive, and in a few days or even hours there is complete motor paralysis of the lower limbs. Quite often the onset is attended with slight or, it may be in rare instances, decided elevation of temperature. Paralysis of the trunk-muscles follows, the sphincters escaping; and finally the muscles of respiration and deglutition are involved, such involvement usually terminating the disease fatally. This order of invasion and progress is, in rare instances, reversed. The motor cranial nerves have been said to have been affected in one or two reported examples of the disease. Minor sensory changes, particularly hyperalgesia or anæsthesia, are not uncommon, though rarely conspicuous. The deep reflexes always, the superficial reflexes occasionally, are abolished. The mental faculties are, as a rule, normal, though a muttering semidelirium is sometimes observed. Bed-sores or other trophic symptoms are rare acci-

dents, though atrophy of the muscles with altered electrical reactions may appear in protracted cases. In the typical disease the cycle is completed in from ten to fifteen days.

Diagnosis.—The diagnosis is quite free from difficulties, as a rule, if the doctrine of an identity with multiple neuritis be accepted. *Per contra*, the rejection of this theory renders the diagnosis between the two often a very complex problem. From fulminant forms of transverse myelitis it is to be distinguished by the involvement of bladder and rectum and the more decided sensory disturbances in the latter affection. In myelitis, too, the deep reflexes are often exaggerated, there is the cincture symptom, trophic symptoms are of early onset and vicious progress, and the duration of acute myelitis even when most malignant is usually more protracted. The acute vascular lesions of the cord—particularly hæmorrhage, if properly localized—may closely simulate symptomatically the disease under discussion. The history of trauma, the apoplectic onset, often with convulsions, and the rapidly fatal termination are data of value in excluding Landry's paralysis.

In 7 cases witnessed, the disease began in all with certain prodromal signs, among which a feeling of lassitude was most complained of. In a short time, paræsis of the legs became pronounced, and the process then extended upward to the trunk, arms, and neck. In two cases the facial nerve was involved and in two the muscles of respiration. There generally is no fever during the onset or at most only a slight rise of temperature and pain does not form a prominent sign at first. Throughout the course the reflexes are absent or much diminished and reaction of degeneration will appear eventually. Ataxia is occasionally present, muscular atrophy appears late and the functions of bladder and rectum are generally

normal. No new facts could be ascertained as to etiology, like in so many cases previously published; no cause for this serious illness could be found in some, while in others there was the usual history of alcoholism, syphilis, and overexertion. The writer looks upon the disease as an acute, ascending neuritis, and believes that if the finer nerve-endings in the muscles were to be examined with modern methods, change would always be found. The process has a tendency to creep up along the nerve-trunks into the cord, but lesions are found here only if the disease runs a more chronic course. It is often hard to differentiate from acute polyneuritis, but here some muscles of each extremity generally escape, and the upward extension of the paralysis may be interrupted by days and even weeks of apparent quiescence. The two conditions really belong to one and the same class. D. Rolly (*Münch. med. Woch.*, Aug. 4, 1903).

Etiology.—It is a disease of early or middle adult life affecting males chiefly. It is not very common. The etiology is not clearly understood, but there is a growing unanimity of opinion to the effect that the disease is due to a toxic infection, the specific nature of which, however, is as yet undetermined. It occasionally follows the infectious fevers. In at least one case seen by the writer, which presented a classical symptom-picture and ended fatally on the eleventh day, gross alcoholism was the cause. Neither climate nor season is known to be etiologically important, nor is heredity a factor.

Landry's paralysis is nothing but the second and third stages of a chronic multiple neuritis that affects the cord by continuity. Here it spreads rapidly, generally upward, sometimes downward, causing death by involvement of the vital centres of the medulla. Krewer (*Zeit. f. klin. Med.*, B. 32, '97).

Pathology.—The pathology is as yet an unsolved problem, though the solu-

tion seems happily not far distant. The results of many autopsies in the past have been negative. Inconstant and widely varying lesions were reported or no determinable lesions whatever could be found, the latter result being the rule until within recent years. The theory of a profound and fulminant molecular disorganization of the anterior-horn motor cell is less than plausible, even as a theory. The doctrine of an identity with poliomyelitis, differing in the acuteness and severity of form only, has been entertained and is based upon much quasi-supportive evidence. That the disease is a pure form of fulminant myelitis is no longer accepted, although it is admitted that the resultant symptom-picture may closely simulate Landry's paralysis. The consensus of present-day neurological belief is that the disease is quite probably a special form of multiple neuritis affecting the lower motor neurons, with secondary changes in the anterior horns and muscles resembling or identical with those observed in poliomyelitis. Ross, Pitres and Vaillard, Eisenlohr, Nauwerk, and many others are among those who have adduced evidence in support of this theory. Pending the final decision and following a well-established precedent, the disease is considered here among the affections of the spinal cord.

Prognosis.—The prognosis is grave always, but the disease is by no means necessarily fatal. Many recoveries have been reported. Should the disease not terminate fatally within two or three weeks the patient will probably recover. In those who recover there is no residual paralysis, the functions of the affected nerves being usually restored to the normal. A special susceptibility to subsequent attack is said to remain, but the statement lacks verification in general experience. The danger to life is, of

course, far greater in those in whom the functions of cardiac action and respiration are affected; but even in such cases recoveries are said to have occurred.

Treatment.—The treatment, as might be inferred from the indefinite etiology, is more or less empirical. The patient should be put to bed at once and kept absolutely quiet. The limbs should be enveloped in lambs' wool fleece or the hot wet pack. Ergot in $\frac{1}{2}$ - or 1-drachm doses every four hours has been employed. Quinine in full doses with or without sodii salicyl. may be used. Small and frequently-repeated doses of mercury or inunctions of mercury are indicated. In plethoric subjects moderate venesection followed by warm saline transfusion suggests itself as a rational procedure. Serum-therapy may prove an aid ultimately. For the late stages of the protracted disease potassium iodide, strychnine, and electricity are indicated. Oxygen has been employed with symptomatic relief in the dyspnoea from respiratory involvement.

Hereditary Ataxia.

Synonyms. — Friedreich's ataxia, or disease; family ataxia.

Definition.—It is a distinctly, though not necessarily a directly, hereditary degenerative disease of the spinal cord, affecting the posterior and lateral columns and the bulbar region, usually beginning in childhood, with symptoms of ataxia, curvature of the spine, defects of speech, talipes, choreiform movements, vertigo, and ultimately paraplegia.

Symptoms.—In very young children the beginning of the disease, or at least the first symptoms, may not be recognized, but may be interpreted simply as indications of slow development or unusual awkwardness. The child does not learn to walk readily; it stumbles and falls easily or staggers in attempting to stand

or walk. The hands are used clumsily and co-ordination appears to be learned with unusual difficulty. In speaking, the child drawls its words. The development of nystagmus, of curvature, or of talipes in some form may prove the first obvious and unmistakable evidence that more than a simple delay in development exists. The disease is much more readily recognized when the symptoms develop later in life, as at eight or ten years of age. Contrast with a previously normal standard renders the symptom-picture much more conspicuous.

The gradually or rapidly increasing ataxia of gait and station; the choreiform ataxia in using the hands; the slow, drawling, thickened or scanning speech; the nystagmus; the club-foot; the curvature of the spine, and the paraplegia are pathognomonic when conjointly associated in early life in two or more members of the same family. Weakness in the legs is present early with the ataxia, and ultimately becomes a more or less complete paraplegia. Sensory symptoms are rare, though, subjectively, headache and slight aching or pains in the limbs may be present. Vertigo is not uncommon. The sphincters are not involved until late in the disease. The knee-jerks are lost, as a rule. Atrophy of muscles and trophic lesions of the skin are exceedingly uncommon except late in the advanced disease. The electrical reactions are usually undisturbed. In a very few cases paresis of the eye-muscles has been noted. Usually some degree of impairment mentally is present in the established disease.

Diagnosis.—There are only two diseases which are likely to confuse the diagnosis: disseminated sclerosis and Huntington's chorea. In the latter the disease occurs in middle life or later, as a rule; the mental faculties are more

markedly involved; the choreiform movements are far more active and extreme; the speech is jerky or explosive; and there is no curvature, no talipes, and usually no nystagmus. From multiple sclerosis the distinction is sometimes impossible. The family history as to direct heredity is of value, but the fact that a brother or sister is similarly affected is less valuable since Dreschfeld and others have reported multiple sclerosis in two members of the same family. The cranial nerves are more frequently affected in disseminated sclerosis; the knee-jerks are often exaggerated; disturbances of sensation are much more common, which is true also of sphincteric involvement. The tremor when present in Friedreich's ataxia is less of the intention type and more like that of chorea. Convulsions and crises, when present, point to multiple sclerosis rather than Friedreich's disease. Remissions do not occur in the latter, while they are not at all uncommon in the former.

Etiology.—The essential predisposing factor is an inherent developmental defect of the spinal cord, especially the postero-internal and lateral columns. The heredity is sometimes direct, but more frequently indirect. Organic insanity, gross alcoholism, syphilis, consanguinity of marriage, epilepsy, or some other degenerative neurosis may constitute the ancestral or parental taint. A generation may be skipped, the parents being apparently healthy, but the grandparent a neurotic. Locomotor ataxia is rare in the family history of this disease. Direct inheritance of the disease itself was found by Griffiths in 33 out of 143 cases. It is somewhat more frequent in males than females (86 males, 57 females—Griffiths's table) and more than two-thirds of all cases develop symptomatically within the first decade of life

(99 out of a total of 143—same author). The disease seems to be more common in America than elsewhere, judging from the published cases, and in this country the victims are, for the most part, from the rural districts rather than the cities. It is the rule to find more than one case in a family, and sometimes several brothers and sisters may be affected in succession. The first obtrusive symptoms may follow an acute illness, especially the infectious fevers.

Pathology.—The gross pathological anatomy has been quite satisfactorily demonstrated in a number of reliable autopsies. The extent of the lesions may vary, however, considerably. The cord appears diminished in bulk and sometimes of eccentric contour macroscopically. Occasionally two central canals have been found or the one central canal may be disproportionately large. Various other developmental anomalies may be present. The morbid process is that of sclerosis, which is always well marked in the lateral pyramidal and postero-internal columns, but may also involve the columns of Türck and the direct cerebellar tract. It does not invade the gray matter, which is usually separated from the diseased columns by a layer of healthy tissue. Dejerine believes the sclerosis found in family ataxia to be really a neuroglial sclerosis or form of so-called gliosis, due to a developmental ectodermal defect. The columns of Goll and the pyramidal tracts are affected in varying degree throughout their entire course. The pathogenesis is as yet undetermined.

Prognosis.—The duration of the disease is indefinite. Death may occur from a bedridden asthenia, but is usually due to some intercurrent affection. The disease may be complicated with insanity.

Treatment.—There is little to be done

for these patients. Suspension has been tried, but has proved about as useless as in true tabes. Arsenic is at times beneficial. The Fraenkel method is indicated for the symptomatic improvement of the ataxia. Prevention of the disease by means of careful selection in marriage, or, better still, celibacy among the tainted, is much the more hopeful and legitimate line of action. Should the disease appear in the first child, further pregnancies or births should be prevented. In the light of the known pathology and the probable pathogenesis, the idea of preventing the development of the disease by withdrawing the infant from the mother's breast, as has been suggested, seems, to say the least, far-fetched.

Ataxic Paraplegia.

Synonyms.—Progressive spastic ataxia; combined postero-lateral sclerosis.

Definition.—As described by Gowers, it is a combination clinically of ataxia and spastic paraplegia, having an anatomical basis in lesion of the dorsal and lateral columns. The disease, while presenting a more or less constant clinical symptom-picture, is probably not a distinct pathological entity.

Symptoms.—The clinical picture is usually clear cut and constant. The first symptom is ordinarily that of constant fatigue, with more or less unsteadiness in standing or walking. This ataxia is especially marked in the dark or with the eyes closed. The sphincters may be affected at the same time and sexual power lost or impaired. There are no sensory symptoms except, perhaps, a subjective aching in the legs and lumbar region. Paretic weakness in the legs, particularly the flexors, gradually and progressively develops. One leg may be more affected than the other at first. More or less rigidity, with exaggerated

knee-jerks, clonus, and contractures, develop. The patient becomes more and more dependent upon assistance in walking, spreading the feet wide apart with eyes fixed upon the floor. The feet are dragged along, however, and not lifted to an unnecessary height and brought down with unnecessary force as in true tabes. The cranial nerves are rarely involved, but the mind undergoes degenerative deterioration in the advanced disease, the mental changes being identical in character, often, with those of general paresis. The arms may be affected in the same way as the legs, with spastic paralysis and inco-ordination. Trophic symptoms are absent.

Diagnosis.—The clinical diagnosis is quite simple. The absence of pupillary changes, of sensory symptoms, and of Westphal's symptom excludes true tabes readily. The spasticity and exaggerated reflexes with clonus may suggest primary lateral sclerosis, but there is no ataxia in the latter affection. Ataxia and parapareses, with exaggerated knee-jerks, may be present in disseminated sclerosis, but there will be, in addition, involvement of the cranial nerves, intention tremor, scanning speech, nystagmus, etc. Tumor affecting the base of the brain and involving the cerebellum may induce symptoms of inco-ordination and spastic paralysis; but here, again, the addition of cranial-nerve symptoms, especially of the optic nerve, will clear away any temporary confusion.

Etiology.—As with most of the degenerative spinal scleroses, ataxic paraplegia is most common in males during middle life, and the causes, so far as known, are also practically the same. Gowers, Osler, and others deny the relationship of syphilis as a cause except in rare instances: a statement, however, which is disputed by the majority of observers.

Lead and other poisons may superinduce the disease. Heredity is a minor factor if it exists at all.

Pathology.—The pathology is a matter of much dispute. As described by Gowers, the lesions consist of sclerosis of the posterior and lateral columns, which is very variable in extent and position and not strictly "systemic" in character, the mixed zone of the lateral and the lateral limiting layer between the pyramidal fibres and the gray matter being involved quite often. In the posterior columns the sclerosis is frequently more marked in the dorsal than in the lumbar segments. Occasionally a zone of sclerosis has been found in the entire periphery of the cord (annular sclerosis). Türck's columns may be affected. Marie, quoted by Osler, does not consider it a systemic disease. He believes the distribution of the sclerosis to be dependent upon the arterial supply through the branches of the dorsal spinal artery, which are involved. By many the disease is believed to be a form of chronic middorsal myelitis, by others simply an atypical form of tabes, and by others still an atypical variety of multiple sclerosis. An identity with general paresis ascending has been maintained. Such wide-spread variations in opinion necessarily leave the final decision still *sub judice*.

Prognosis.—Except in the syphilitic cases, the prognosis is bad. The duration of the disease is extremely variable. It is essentially slow, however, in progress, and often many years elapse before the victim succumbs. Paralytic helplessness may develop, however, within a few years and become complete. When mental symptoms are manifest early in the disease the prognosis is proportionally worse.

Treatment.—Potassium iodide should

be invariably tried in this disease. No harm can result, and the patient is given the benefit of the possibility that syphilis may be the cause.

Syringomyelia.

Definition.—The term etymologically signifies a cavity (abnormal) within the substance of the spinal cord. Such a literal and limited definition is, however, inaccurate and misleading. By almost general consent the word has been restricted in its application to a disease characterized anatomically by lesion usually and chiefly of the central substance of the cord; pathologically by a gliosis or gliomatosis dependent upon embryonal-tissue persistence, with subsequent perverted cellular proliferation and ultimate cavity-formation; clinically by the presence, in association, of progressive muscular atrophy, dissociation of sensation, prominent trophic symptoms, and scoliosis.

Symptoms.—The clinical picture in syringomyelia is exceedingly variable, as may be inferred from the morbid anatomy. There is not a function of the cord which may not be perverted, and, on the other hand, no disturbance at all may be present or at least recognized. There is no single pathognomonic symptom, nor is there any constant grouping of symptoms which is positively characteristic of the disease. The attempt has been made to classify the disease into clinical subtypes according to the locality first or most affected or the predominance of motor, sensory, or trophic symptoms. Such subdivisions are obviously of but little value. In the very small number of cases in which the diagnosis has been made during life and confirmed by autopsy the clinical history has been about as follows: The patient first notices some aching and pain in the neck, shoulders, and arms, with paræ-

thesiæ in the hands and fingers. This is followed by an atrophy which slowly affects, first, the smaller muscles of the fingers and hand, and which is attended with fibrillary twitches. Analgesia develops in varying degree in the affected limb, and thermo-anæsthesia, sometimes complete, is also present. Tactile perception may remain either normal or only slightly impaired, and this combination of analgesia with thermo-anæsthesia and preserved tactile perception constitutes the so-called dissociation of sensation at one time erroneously supposed to be



A type of deformity in syringomyelia.

pathognomonic of syringomyelia. Following the atrophy and sensory disturbances, trophic lesions of the skin, hair, nails, bones, etc., develop, and are often quite prominent. Herpes, bullæ, ulcers, felons, and gangrene, usually painless, are among the skin lesions observed. Extensive arthropathies have been noted, and the bones may become quite brittle. Vasomotor symptoms—such as sweating, œdema, redness, or cyanotic discoloration in certain areas or a limb—are quite common. As the disease extends from above downward, the trunk-muscles become involved, and scoliosis, or curvature, de-

velops. Extending still lower, the legs are affected with paraplegic weakness, the sphincters become paralyzed, and sexual power is lost. Just as with the upper, the first symptoms indicating involvement of the lower cord may be irritative—paræsthesiæ may precede the paraplegia. Should the disease extend upward, bulbar symptoms are added. The trigeminus may be affected and facial atrophy appear. Pupillary abnormalities have been noted occasionally, particularly an inequality in size and response. The eyeball may appear protuberant as in exophthalmic goitre, or the globe may appear to have receded, with narrowing of the interlid space. This condition is often associated with facial hemiatrophy (Schulte). Ataxia of both lower and upper extremities has been observed. The muscular sense, however, may remain normal.

The symptoms are usually bilateral, though they may at first and for some time be limited to one side, and they are often unequal in degree on the two sides. The first symptom may be referable to the dorso-lumbar or the bulbar segments, in which case, of course, the order of sequence would be reversed. This is the basis for the so-called bulbar and paraplegic types. In certain cases trophic symptoms predominate, due, it has been thought, to a complicating neuritis. Morvan's disease is assumed by many to be essentially identical with this form of syringomyelia. The identity has not yet been proved, although the clinical resemblance is certainly strikingly suggestive.

From a study of over five hundred papers which have been published on syringomyelia, it was found that the following are some of the more characteristic features besides those of progressive muscular atrophy and paraplegia:—

1. The arthropathies of syringomyelia may be divided into two classes: the atrophic, which is the rarer; and the hypertrophic, which in many ways resembles osteoarthritis. These changes in the joints are much more frequent in the upper than in the lower extremities.

2. In 50 per cent. of the cases there is more or less deviation of the spinal column, usually laterally; one type of deformity being shown in the above figure.

3. Vasomotor disturbances are often well marked, particularly by sensation of cold and local areas with excessive sweating.

4. The action of the sphincters is generally normal.

5. Ocular symptoms: Pupils are frequently unequal. Nystagmus has been occasionally noted. Optic disks are generally normal.

6. When the medulla is invaded by the glioma, bulbar symptoms ensue, particularly laryngeal paralysis, while the involvement of the several nerves arising from the pons and medulla will cause corresponding symptoms.

The most characteristic symptoms are due to degenerative changes in the posterior horns of the cord, more particularly the disassociation of thermo-anæsthesia from defects of the other sensations. Innsdale (*Inter. Med. Mag.*, Jan., '97).

The boat-shaped deformity of the thorax, met with in some cases of syringomyelia, consists in a characteristic depression of the central portion of the anterior wall of the chest above the lower margins of the great pectoral muscles, on either side of which the chest-wall rises, so that the shoulders appear to be brought forward. This depression is a trophic lesion analogous to those affecting other parts of the skeleton in the same disease. Astié (*Thèse de Paris*, No. 225, '96-'97).

Diagnosis.—With our present knowledge, or rather lack of it, an inaccurate diagnosis in syringomyelia is not a serious reflection upon individual skill. Of the affections with which it is most likely to be confounded, tumor and hæmor-

rhage of the cord, myelitis, pachymeningitis, particularly cervicalis hypertrophica, progressive muscular atrophy, and tabes dorsalis are chief in importance. In tumor all irritative symptoms—such as pain, spasm, etc.—are usually far more pronounced, the symptoms are more definitely localized and unilateral, and the rate of progress is more rapid. Tumor elsewhere, especially if malignant, is significant. In cord hæmorrhage or embolism the onset is abrupt and apoplectiform in nature and the symptoms are rapidly destructive. From myelitis the diagnosis may be, at times, difficult. The more widely distributed symptoms and the more extensive involvement of all forms of sensation, with the relative infrequency of true trophic symptoms in myelitis, should prove sufficient data. The muscular atrophy is often late in myelitis and is more rapid after once beginning. From cervical pachymeningitis the differential diagnosis is at times impossible during life. It is only when tabes dorsalis begins with extensive and vicious trophic symptoms or when, as has been noted occasionally, a tabetic presents the symptom of dissociated sensation that any temporary hesitancy between the two diseases occurs. In leprosy we may have analgesia and severe trophic lesions, but there is no atrophy, scoliosis, or dissociated sensation as in syringomyelia.

Etiology.—The disease is comparatively rare. More cases have been reported among males than females and a large percentage of reported cases have been recognized first between the ages of 25 and 35 years. The essential causative factor is an inherent predisposition dating back to embryonal life. Syringomyelia is not directly hereditary nor is it a "family" disease. No adequate or satisfactory explanation has been offered for

the cause of the developmental defect which primarily underlies the disease. Cleft palate, harelip, spina bifida, and other similar defects afford probable analogies. The exciting cause is most often trauma. Prolonged exposure to severe cold and dampness, overexertion physically, toxæmias, malnutrition, and anæmia are some of the contributory or exciting causes to which individual cases have been ascribed. Syphilis and alcoholism may be indirect etiological factors.

Pathology.—Cavities of the cord may exist as congenital doubling, diverticula, or other anomalies of the central canal, or they may be secondary to acute lesions, such as abscess, hæmorrhage, tumor, etc. Simple dilatation, more or less extreme, of the normal canal may occur, which is known as hydromyelia and which often is unattended by any symptoms whatever, its presence being a post-mortem revelation. In some instances hydromyelia gives rise to symptoms identical with syringomyelia, but the essential pathological basis of the latter disease is a central gliosis of insidious beginning and slow advance. This gliosis originates as follows: In the embryo the central canal or primitive tube is quite large relatively. In the normal development of the embryo this canal closes by gradual approximation of its walls posteriorly, which, uniting, form the normal posterior septum. The anterior walls remain separate, forming the normal central canal. Interruption or perversion of the normal development results in the formation of a cavity. Such interruption may be localized to one or more segments, or it may extend for some distance through the cord. The cell-elements remain of the embryonal or glia type. They are distributed irregularly in the cavity-walls, sometimes occurring as nests resting upon a basement material. These ependymal

and periependymal cells and neuroglial or basement tissue, later in life, through the stimulus of trauma or some other exciting cause, begin to undergo proliferation, forming gliomatous masses. The proliferation extends from centre toward periphery and also longitudinally, usually in the posterior areas of the cord first. The most common locality affected is the cervical cord. This new gliomatous tissue, either from inherently diminished vitality or from hæmorrhage or other vascular lesion incidental to the imperfect blood-supply, breaks down and a cavity results. The gliosis may not always end in cavity-formation, but may remain as a tumor or as simple glia hyperplasia, which, however, destroys, by pressure, the normal motor and sensory cell-bodies and their axons or axis-cylinders quite as effectually as does the breaking-down. The tendency to cavity-formation is said to be proportionate to the excess of cellular over basement tissue in the gliosis. Secondarily atrophy of the muscles and various forms of peripheral neuritis are among the pathological findings.

About two hundred spinal cords in embryos, newborn infants, and children under two years of age examined. Hæmorrhage into the posterior horns of the cervical cord, while not frequent after difficult labor, seems a characteristic condition. Simple hydromyelia is not pathological, yet a complicated cavernous condition may develop in the spinal cord from simple hydromyelia. In one case, a child of nineteen months, a progressive widening of the central canal occurred, combined with an increase of the neuroglial tissue, a distinctly pathological condition. In a case of anencephalus congenital hydromyelia occurred in the cervical region, as in syringomyelia. After reporting with histological detail several cases the writer concludes that a surely congenital neuroglial hyperplasia was not found in any case, but that there seems to be some relation

between this infantile syringomyelia and other abnormalities of the cerebral nervous system. Thus it is seen that syringomyelia may be congenital and traumatic. J. Zappert (Wiener klin. Wochens., Oct. 10, 1901).

Prognosis.—There is no cure for the disease; hence an unfavorable prognosis must be given as regards recovery. The disease may progress very slowly, however, and a duration of twenty or more years is said to be not uncommon. The progress of the disease may be spontaneously arrested, the symptoms remitting. Such remissions may last through several years.

Treatment.—Gliomatosis of the cord is not amenable to curative or even palliative treatment by any means as yet attainable. Potassium iodide has occasionally proved to be of service in gliomatous tumors of the brain and should be tried faithfully. Silver nitrate, gold salts, arsenic, and iodine are theoretically indicated. Electricity has been almost invariably disappointing, except as a tonic. Change of climate, rest, and general tonic treatment offer the best prospect for an arrest of progress in the disease and the consequent prolongation of life.

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SPINE, DISEASES AND INJURIES OF.

Tuberculosis of the Spine.

Synonyms. — Pott's disease; spondylitis.

Tuberculosis of the spine—of the vertebræ—makes up the vast majority of group of cases classed under the head of Pott's disease, so called because of the very elaborate account given to it by Percival Pott a little over a hundred years ago. The name of spondylitis has also been given by the Germans to this affection.

The subject of *bone tuberculosis* has already been discussed under the head of HIP-JOINT DISEASE (see volume iii). What was then said of the growth of tubercle in the femur also applies to tuberculosis of the spine.

Symptoms and Diagnosis.—As a rule, the primary focus of disease is in the cancellous tissue of the body of a vertebra, spreading slowly until the intervertebral cartilages connecting this vertebra with its fellows are involved. It is rare for the disease to remain confined to a single vertebra. It more usually involves several contiguous vertebræ, or there may be present several spots of inflammation, at different locations in the spine, some of which may appear months or even years after the primary infection. If the disease is not arrested, the body of the vertebra is gradually destroyed by the advance of necrosis, and, as a usual thing, unless support is applied to the spine, the superincumbent weight of the body crushes together the softened vertebræ, causing an angle, of greater or less extent, to take place in the spinal column, with a protrusion of the spinous processes. As a rule, the erosion has been toward the front of the bodies of the vertebræ, and the angle takes an antero-posterior position accordingly. But it occasionally happens that the vertebræ have been destroyed more on one side than the other, and a marked bend to this side takes the place of the ordinary antero-posterior deviation. It occasionally happens also, even without the use of apparatus, that large amounts of cancellous tissue are destroyed, even the entire bodies of two or three vertebræ, without the occurrence of deformity, as enough inflammation has been previously set up in the periosteum to cause proliferation of bone between the transverse processes, the vertebræ

becoming firmly ankylosed in a straight position.

Sometimes the seat of the tuberculosis is not between two vertebræ, but in a costo-vertebral articulation. This point must be borne in mind in making a diagnosis before excluding vertebral tuberculosis. Occasionally the focus of disease is found in the transverse arch or



Fig. 1.—Lumbar Pott's disease, with beginning psoas abscess, simulating lateral curvature of the spine in the position patient holds her body. (*R. H. Sayre.*)

in the spinous processes of a vertebra, but such cases are very rare.

As occurs in tuberculosis of bone elsewhere, the formation of abscess quite frequently accompanies tuberculosis of the vertebræ. The abscess may extend into the vertebral canal, so as to press on the spinal cord, and give rise to paralysis. It also may point anteriorly, and, if in the right situation, may give

rise to so much pressure on the trachea or bifurcation of the bronchi as to impede respiration. It may rupture into a bronchus and the pus be expectorated or it may cause suffocation; it may find its way into the pleural cavity and set up a pleurisy; or it may perforate the bladder or the rectum; but usually such abscesses, if in the dorso-lumbar region, burrow a tract along the course of the psoas muscles, and point either below Poupart's ligament or in the lumbar region, just above the posterior iliac spines.

In the cervical spine these abscesses at times burrow until they penetrate the mediastinum with most disastrous consequences.

In cases of spinal disease a differential diagnosis must be made between tuberculosis, syphilis, and rickets, and this, at times, may be very difficult. If the child be below two years of age, and have several foci of disease in the spine, several other joints involved, or show evidences of syphilis elsewhere, or the parents be known to be syphilitic, it should receive antisyphilitic treatment in addition to protection for its spine.

If evidences of rickets show themselves in large epiphyses, beaded ribs, open fontanelles, abnormal sweating about the head, the spinal curvature is probably rachitic, and a more favorable prognosis may be given accordingly. If the diagnosis is correct, prompt improvement will follow changing the diet and administering phosphorus and cod-liver-oil. The necessity for support for the spine is, however, as necessary as if tuberculosis were present; but the chances are that it will be required for only a short time.

Pott's disease in the nursling personally observed 26 times. The seat of lesion was always the lumbar segment of the vertebral column, at the first or sec-

ond vertebræ, 22 out of 26 times. There is at first always paraplegia, followed by rigidity of the lumbar region, and then a large lumbar gibbosity, not angular. The paraplegia may be distinguished from infantile palsy by the fact that it affects both legs, is never complete, and the reaction of degeneration is not present. From rachitis it may be differentiated by the freedom from pain on pressure.

When deformity is the first symptom it may simulate rachitic lumbar kyphosis or a transitory vicious attitude. In either of these conditions the lumbar portion of the spine remains supple, and when there is ankylosis in rachitis it is a lumbo-dorsal kyphosis, which is readily recognized. Froelich (*Annales de Méd. et Chir. Infant.*, Jan. 15, '99).

A large proportion of the cases of tuberculosis of the spine do not prove fatal, and, if adequate mechanical support is applied before the occurrence of a deformity, the latter should be prevented, or at least should not be conspicuous. As in tuberculosis in other joints, absolute rest of the inflamed area and the building-up of the patient's general nutrition to the highest possible point are the two essentials of treatment. A certain percentage under the best of care do not improve, but develop abscesses, have amyloid changes in the viscera, or develop pulmonary or meningeal tuberculosis, the latter being much more frequent.

In order to secure a favorable position of the spine, early diagnosis is important, as the disease, in all instances, precedes the deformity for a considerable time, and deformity here, as elsewhere, is more easily prevented than cured. Pain, muscular spasm, and slight elevation of temperature are the three diagnostic points to be noted. The pain is referred to the distal extremity of the nerves which pass from the spine at the point of inflammation, and the symp-

toms, in consequence, vary with the location of the disease. In the first and second cervical vertebræ occipital headache may be noted, and the position of the head may resemble very strongly that of torticollis. In torticollis, however, the face looks upward and away from the contracted muscles, while in cervical tuberculosis the face, though turned to one side, is directed downward rather than upward, in my experience. In torticollis pain is not present, and the muscular spasm pathognomonic of joint inflammation does not exist: simply a chronic contracture of certain muscles. An elevation of the temperature, to 99° or $99\frac{1}{2}^{\circ}$, will also probably be found associated with tuberculosis.

One symptom which is pathognomonic of inflammation in the first and second cervical vertebræ is pain, or sometimes a sense of impending death on being placed in the recumbent position. The writer has seen patients with disease in this region who have been unable to lie down to sleep for weeks at a time, until adequate support was applied. The anatomical construction of the first and second vertebræ accounts for this peculiarity. While recumbent, the weight of the head presses the body of the atlas back against the odontoid process of the axis, while in the upright or slightly anteflexed position the latter is freed from pressure, and, therefore, this position is chosen by preference when the disease is situated in these two vertebræ, whereas recumbency gives relief when the disease is in any other portion of the spine.

With this particular location a prognosis must always be reserved, as the possibility of entire erosion of the odontoid process or rupture of the check ligaments and consequent fatal pressure on the cord must always be borne in

mind, although a case has been reported in which the entire odontoid process has sloughed away and been expelled through an abscess, with recovery of the patient, the vertebræ having been ankylosed previous to the destruction of the odontoid.

A little lower in the neck the disease gives rise to difficulty in respiration, and a curious kind of breathing, somewhat resembling the noise of croup or whooping-cough, while at the dorso-cervical junction the disease at times produces auscultatory sounds which exactly resemble a general bronchitis, and which disappear when traction is made upon the head, to reappear again the moment it is relaxed. In the majority of cases of upper dorsal disease there is a peculiar grunting respiration which is pathognomonic, and once heard cannot be mistaken.

When the disease is situated in the dorsal region, pain may be referred to the front part of the chest or pit of the stomach, and the diagnosis of indigestion made in consequence, while, when it is a little lower in the spine, the child is often treated for worms and colic for months before the actual nature of the disease is ascertained. In this region also, pain may be referred to the bladder, perineum, or the rectum, and in the lower lumbar region differential diagnosis between disease of the spine and hip may possibly be called in question, the pain being referred to the inner side of the thigh and to the knee. At times, with disease in the lumbar region, a sharp contraction of the abdominal muscles may be noted, before the appearance of a knuckle in the spine, giving the appearance of a string tied tightly around the belly.

It is rare for pain to be felt at the point of disease, except when disease has

been in existence for some time, and this pain is usually elicited by blows and jars or sudden twisting of the spine, and not by direct pressure; in fact, in many cases, if the patient be laid face downward and pressure made on the knuckle, relief and not pain will be given, on account of the removal of pressure from the inflamed surfaces.

The gait of the patient with spinal disease is most characteristic. There is a careful, apprehensive tread, the ankles, knees, and hips being flexed to avoid jarring the spine; and the patient steps upon the toes instead of walking with the heels first striking the ground, as is usual. On bending to pick up an object a child with Pott's disease will flex the ankles, knees, and hips, and squat down, rather than bend forward, in the normal attitude which a child would assume, and in walking around a room will frequently support itself by the table, chairs, or any other object which is convenient, taking care not to release its grasp of one until it has secure hold of another. If compelled to walk by itself, it may support its trunk by placing both hands on its thighs and stiffening the arms, thus transferring the superincumbent weight of its body to its legs by means of the arms, and relieving the spine of pressure. Usually, these patients will complain that riding in street-cars or across rough pavements causes pain, and that, under these circumstances, they are obliged to place their hands on the seat of the carriage, and support the body in this manner. If the disease is high up in the spine, the head is very frequently supported by the fingers placed beneath the chin, and on looking to either side the entire body is rotated, and not simply the neck. When the disease is in the dorsal region the child often walks with the head thrown as

far back as possible, the face looking toward the sky, in order to relieve the front part of the bodies of the vertebræ from pressure, and a mistaken diagnosis of cervical disease be made in consequence.

The diagnosis, of course, is simple if the disease has advanced sufficiently far to produce deformity, but, long before the occurrence of the latter, symptoms are present which, if properly interpreted, will enable the physician to arrive at a correct diagnosis. It is important that the patient's trunk be stripped, and the attitude carefully noted. The clothing having been removed from the trunk, the patient should be made to bend forward and backward and to both sides, the occurrence of spasm in any of the muscles of the trunk being carefully noted. Marked tenderness to pressure along the entire length of the spine, without the occurrence of muscular spasm or deformity is a pretty sure indication of the so-called "hysterical" spine, as opposed to tuberculosis. If muscular spasm be found on any manipulation of the spine, any pain on bending or on concussion, with pains referred to the anterior part of the body, combined with an elevation of perhaps a degree in the temperature, the chances are almost certain that you have to deal with an inflammation of the spine, even though no deformity is apparent.

In such cases, where no deformity exists and the vertebral joints are healthy, it is well to examine the costo-vertebral articulations, taking the ribs one by one and pressing their heads against the vertebræ, in order to detect, if possible, any inflammation in this situation. In doubtful cases if the temperature is elevated the chances are that inflammation is present in the spine, and

it should be protected accordingly until time shall have cleared up the diagnosis.

Hyperæsthesia in the region of the lumbar spine does not afford a sufficient reason to admit the existence of Pott's disease, especially when the other symptoms of the affection are entirely absent; but it is well, nevertheless, to be careful, for a superficial examination of a patient may lead to an error. Gendron and Brunet (*Ann. de la Policlin. de Bordeaux*, July, '96).

Among the conditions which simulate caries are the following: 1. Neuroses of the spine. There is pain in the back and points of tenderness over the spinous processes and lateral processes. Often there is a history of injury. 2. Lateral curvature, accompanied by pain and tenderness. 3. Rheumatic spondylitis. 4. Fracture of the spine. 5. Multiple osteomyelitis (tuberculous), involving some portion of the vertebræ. 6. Malignant disease of the vertebræ. V. P. Gibney (*Med. News*, Feb. 20, '97).

In all patients attacked by Pott's disease, adults or children, some changes are produced in the height. In adults it diminishes before old age, even without the occurrence of the hump. In children the growth of the spine is arrested, and the height increases only by increase in the lower limbs and head. In the early stages of the disease the height diminishes. The growth of the posterior arch and the cuneiform flattening of the bodies only aggravate the gibbosity without elongating the vertical dimensions of the thorax. The child regains its powers of growth when the curve is reduced, and along with this comes a correction of the form of the thorax, and an improvement in the vital forces from the better condition under which the thoracic and abdominal viscera act. Bilhaut (*Ann. de Chir. et d'Orthop.*, Jan., '98).

In Pott's disease the foci of disease both in antero-posterior and lateral views have been demonstrated by the radiograph. The initial lesions are detected in this manner.

The radiograph shows how many vertebræ are affected and to what extent. It also shows the extent of the lesions, the loss of substance, the existence of

sequestra and tubercular cavities, the degree and cause of the refection of the thorax. In cases in which the abscess has been treated by iodoform injections the size of the abscess and its shape are clearly shown.

Radiographs taken at different periods mark the progress or regression of the disease. Redard and Larau (*Revue de Chir.*, Nov., '98; suppl.).

The characteristic attitudes of Pott's disease, although early and important signs, are also seen in osteitis of a syphilitic or malignant origin. It is important, therefore, to consider the personal and family history, the age, the location of the disease, and the mode of onset as well as the pain and tenderness. Pain in the terminations of the nerves is not so early or so prominent a symptom in the lumbar as in the dorsal region, while local tenderness is more apt to be recognized in the cervical than in the other spinal regions. In the cervical region the vertebral articulations may become infected by organisms gaining access from the pharynx after measles or scarlet fever, with resulting muscular spasms and malpositions of the head simulating those of Pott's disease, and it may be a long time before it can be decided that a post-pharyngeal abscess has its origin in vertebral caries. A long time may also elapse before it can be known that a traumatic osteitis in the cervical or lumbar region has become tuberculous. There are absolutely no pathognomonic symptoms. Myers (*Med. News*, Jan. 12, 1901).

Etiology.—Traumatism plays a most important part in tuberculosis of the spine, as it does in tuberculosis elsewhere, and by careful study of the case an injury can very frequently be traced as the exciting cause of the tuberculosis. The gradual way in which tuberculosis usually develops causes observers frequently to overlook the connection between the traumatism and the disease, just as the disease is frequently overlooked or mistaken for something else until the appearance of a knuckle in the

spine, which is usually months and sometimes years after the onset of the first symptoms of peripheral nerve irritation.

The following are some of the results noted from a collection of the statistics of spondylitis from the pens of a large number of the leading surgeons, and also from personal experience. Among 187,260 patients spondylitis occurred 810 times, and most of the cases developed before the tenth year of life, and after 15 there was a sharp decline in the percentage of cases; 53.25 per cent. were males. As an etiological factor trauma was present in 53 per cent. of the cases of spondylitis, and in 16.6 per cent. were hereditary tendencies traceable. The seat of predilection was the lower dorsal, scarcely less frequent were the lumbar vertebræ attacked, while the lower cervical was very seldom assailed. Vulpus (*Archiv f. klin. Chir.*, B. 58, H. 2, '99).

Treatment.—The diagnosis having been established, treatment should consist of physiological rest of the inflamed vertebræ. In children under three years of age, this is best secured by recumbency in a wire cuirass comfortably padded and made to fit the shape of the entire child. In this cuirass the child is placed and the legs and the body bandaged to hold it firmly in position; traction is then made upon its head by means of a leathern head-support, which passes under the chin and occiput, and is attached to a cross-bar which is suspended from an upright fastened to the cuirass. Unless traction is made upon the spine in this manner, a knuckle is very sure to develop from reflex muscular spasm, even in spite of the recumbent position.

If the disease is in the upper dorsal region, provision should be made for holding the shoulders by means of the attachment suggested by Dr. Whitman, which consists of two hard-rubber caps which fit the heads of the humeri and which are connected together by a steel rod passing across the front of the chest;

the straps pass above and below the shoulders from buttons on the rubber caps to the back part of the cuirass, and the shoulders are thus held thrown well backward.

The use of straps passing around the shoulders to hold the latter back is decidedly less efficacious than the Whitman apparatus, which exerts pressure on the heads of the humeri and by means of the rod keeps them thrown well back and thus controls more effectively the movement of the vertebræ.

In the cuirass the child may be taken out in a large baby carriage, and receive the benefits of sunshine and fresh air. The bandages should be removed every day, and the child's skin kept in proper condition. Every few days, if need be, the child may be removed from the cuirass, by rolling it on its stomach, and washed with water and a little alcohol. This treatment is much to be preferred to keeping the child recumbent in a cot, with traction on the head with weight and pulley, as in the cuirass it is able to enjoy the benefits of out-door life and be carried up and down stairs, which is not practicable with the use of bed treatment. The child should be placed in the upright position as little as possible, and pass most of its time recumbent. If simultaneous disease of the knee or hip is present with spinal tuberculosis, the cuirass is also the proper treatment.

If the child be larger, and the pelvis sufficiently developed to be used as a point of support, apparatus may be applied to protect the spine and allow the child to walk.

If the disease is in the cervical region, a jury-mast should be applied, which may be fastened either to a plaster jacket or to a steel back-brace. If the latter is used, it must receive support

either from the shoulders of the child or from the crests of the ilium, the latter being, by all odds, the best point from which to make upward traction, as pressure on the shoulders is not only inconvenient, but variable, the scapulæ being constantly in motion.

If the disease is in the first or second cervical vertebra, the head must be held absolutely rigid, and prevented from rotating by means of a metal head-support fastened in position by a brow-band and connected to a body-brace by a rod passing down the back of the neck having universal joints at the occiput and seventh cervical vertebræ in order that the apparatus may be adjusted to the head in its position of distortion and gradually altered as the subsidence of inflammation allows the head to be placed in a more normal position.

If the head is not turned far from a straight line, it may not be necessary to use the two universal joints, and simple uprights of malleable iron bent to fit the shape of the neck and head will suffice, the ordinary jury-mast being used for this purpose. If it is not practicable to obtain such an apparatus, plaster-of-Paris bandages enveloping the head, neck, and trunk, like a suit of armor, may be used with success.

In the lower cervical vertebræ rotation may be permitted.

If the disease is in the upper dorsal vertebræ, any apparatus which is not supplied with means for sustaining the superincumbent weight of the head is defective, whether it be an antero-posterior steel brace or a plaster jacket.

With the disease in the dorsal region, the spine may be supported with the antero-posterior steel brace.

A spinal brace should be made of steel so tempered as to be capable of being bent by a large pair of monkey wrenches,

and should be accurately fitted so as to support the entire spine. There should be two back-bars, one lying on each side of the spinous processes, and connected by cross-rods, which should be so curved as not to press on the spine where they cross it. There should also be a pelvic belt, with padded bands attached, which pass over the iliac crests, in order that the weight of the head may be transmitted here and so removed from the inflamed vertebræ. Control of the head is obtained by a metal rod passing from the back-bars of the brace over the top of the head and supplied with a cross-bar from which depend a leathern head-support passing under the chin and occiput. From the back-bar project other bars which pass behind the scapulæ and project a trifle above the shoulder, and from these straps pass in front of the shoulders and under the axillæ, and fasten again to buckles on the back-bars. The reason these bars project above the shoulders is to prevent the straps from crowding the shoulders down, as they are only intended to force them back. As the straps by themselves would slip into the fold between the humerus and the chest, they are kept from so doing by fastening them to two concave rubber caps which rest against the front of each humerus and are connected by a curved metal bar, according to Dr. Whitman's suggestion, which keeps them apart; and in this manner the motion of the shoulders is much more effectually controlled than if the straps alone were employed. A linen apron with straps to fasten it to the back-bars keeps the entire apparatus in place. In order that this shall be of use it must support the spine accurately, and should be fitted with great care. The patient should be placed in the prone position and the outline of the spine taken with a strip of

flexible lead or other metal and the back-bars then bent to conform to this outline by means of a pair of wrenches. The bars may require to be twisted sideways as well as in an antero-posterior direction, and should be so adjusted that when the patient is upright the entire spine is thoroughly supported. This will be found to be a difficult task in cases presenting decided deformity. The fitting of such apparatus should be done by the physician himself in his office, and not left to the instrument-maker, and upon the perfection of support will depend the benefit derived from the apparatus.

In many cases the improved position of the patient requires that the back-bars should be straightened from time to time.

The application of a steel brace of any make in Pott's disease of the spine, where there is the least lateral deviation, is a practice to be condemned, because such cases invariably increase in deformity, on account of the mechanical conditions in the vertebral column. Destruction of bone will certainly increase, whereas, if suspension is applied and a properly-fitting corset adjusted, no pressure is made at point of disease, and the rotation will not increase. Patients with Pott's disease of the spine treated with the aluminum corset are enabled to go in bathing at the sea-side during the summer months, which is a very great advantage. A. M. Phelps (Med. Register, Apr. 15, '99).

In my experience better results are obtained from the use of the plaster-of-Paris jacket than from any other means of support except in cervical and high-dorsal cases, where a steel brace is preferable.

In applying plaster-of-Paris bandages to make a jacket the following directions should carefully be observed:—

Cross-barred muslin or crinoline should be the material used in making

the bandages. Frequently the kind of sizing used in the manufacture of this muslin prevents the plaster from setting quickly. It should therefore be washed to get rid of the superfluous sizing before being torn into strips from three to four inches in width and three yards in length. Of course, the selvage is to be torn off. These strips are drawn through a tray filled with freshly-ground plaster of Paris, and enough rubbed into the muslin to fill all the meshes. The bandages are then rolled moderately tight and laid in an air-tight tin until required for use.

The patient should have the body covered with a tightly fitting knitted or woven woolen shirt, without sleeves, tied tightly over the shoulders and drawn down and securely pinned over a folded towel in the perineum. For this purpose a safety-pin should always be used. If the patient is a female, pads of proper thickness should be placed over the mammæ and under the shirt, which pads are to be removed when the plaster sets, thus preventing pressure on these glands. Another towel, folded in such a shape as to cover the stomach and bowels, called the "dinner-pad," which also is to be removed after the plaster sets, is placed inside the shirt, thus providing space for the expansion of the stomach during the process of digestion. If the patient has partaken of a hearty meal just previous to the application of the plaster, this dinner-pad may be omitted.

The patient now being prepared for the application of the bandages is placed in the suspension apparatus, which consists of a pair of padded straps, which pass under the axillæ, and a leathern head-piece, which passes under the chin and occiput, all of which are suspended from an iron rod, which, in turn, hangs

from a compound pulley suspended from the ceiling, door, or other convenient place. For use in patients' houses a folding tripod of wood is very convenient. Traction is now made on the head and arms evenly, the straps being lengthened or shortened until the pressure is evenly distributed.

Traction is now made very slowly and gently, and only carried to the point of giving the patient perfect comfort, and never beyond that point.

In some cases the heels will be slightly raised from the floor before this point is reached, but in many instances the heels will not be raised from the floor at all; and as the sensations of the patient are the only guide as to the amount of traction needed, an anæsthetic should under no circumstances ever be given, as has been done by some surgeons, as one requires the intelligent co-operation of the patient himself in regard to the amount of traction required. If it is a child not old enough to talk and tell its feelings, watch carefully the expression of its countenance; and when it is changed from pain to pleasure, there stop, never making traction beyond that point, and immediately apply the plaster bandages with great care and accuracy, pressing them into all the irregularities and covering the entire trunk from the pelvis to the top of the sternum.

If the patient is kept suspended in this position till the plaster is set, it will retain the body in the position of perfect comfort which suspension has given it.

In applying the bandages one should be placed on end in a basin or pail of tepid water, deep enough to completely submerge it, when bubbles of gas will at once begin to escape. As soon as the bubbles cease, the plaster will be all moistened and the bandage ready for use. Do not add salt to the water, as it

renders the plaster brittle. Squeeze out the superfluous water before applying it, and place another roll, end up, in the water, which will be ready for use by the time the first one has been applied, and proceed thus until the entire jacket has been completed. The reason for placing the bandages on end in the water is that the gas may escape and thus enable all the plaster in the roll to be evenly moistened. If laid on the side, the moisture will only extend to some parts, leaving others dry and unfit for use.

The patient being suspended, the jacket is applied by the surgeon, standing or sitting at the back of the patient, while an assistant sits in front, steadying the patient by his knees and rubbing and smoothing the bandages which are being applied.

Begin at the waist, taking one or two turns around the smallest part of the body, and then going down in a spiral form, each layer overlapping the other half or two-thirds of the width of the bandage until reaching the trochanters; then, having taken one or two turns around the pelvis, reverse the bandage, and gradually proceed in the same spiral manner upward until you have covered the entire body to the top of the sternum.

This process is repeated till the jacket is sufficiently thick to support the body, the number of bandages required for this purpose, of course, depending on the size of the patient.

In cases where the disease is in the lower loral or lumbar vertebræ this is all that is required. If the disease is at the middorsal or cervical vertebræ, it then becomes necessary to add the jury-mast to the jacket in order to take off the weight of the head from the vertebral column.

In many instances great advantage is derived from the addition of Whitman's shoulder-brace to keep the chest well expanded, and press the shoulders back into the jacket.

Several modifications have been made in the application of plaster bandages, as Davies's hammock, in which the patient was suspended, face downward, while traction was made on the head and heels by an assistant. Goldthwaite, of Boston, has recently advocated the application of plaster jackets while the patient lies on the back, traction being made on the head and heels by a windlass, the most prominent part of the curvature being supported by a little upright, the weight of the patient's head and shoulders tending to correct the deformity. Goldthwaite, in this manner, claims to have produced a very great improvement in curvature of the spine in various cases.

Taylor, of Baltimore, applies plaster jackets, the patient being fastened to a bicycle-saddle, while pressure is made against the kyphos and the sternum by means of arms which project from the apparatus, while traction is made on the head, upward and backward, by means of a pulley.

In the great majority of cases the jacket can be applied while the patient is suspended vertically, with the greatest ease to himself and the surgeon; but in exceptional cases, where there is paralysis, where the heart is too weak to allow the patient to remain upright for any length of time, or in cases of excessively fat and feeble people, Davies's hammock, with holes cut to allow projection of the head and feet, or Goldthwaite's apparatus is to be preferred, traction being made at both ends of the body to the point of comfort while the jacket is being applied.

The kyphotone is intended to make traction backward on the trunk and spine during the application of the plaster jacket. The advantages claimed for it are: (1) the spine is fixed in the most advantageous position; (2) the rapidity and ease with which the jacket can be applied; (3) its applicability to cases of middorsal, lower dorsal, and lumbar caries; (4) the removal of the superincumbent weight from the diseased articular processes; and (5) the inexpensiveness of the apparatus. R. T. Taylor (*Phila. Med. Jour.*, June 17, '99).

Appliances which require infrequent adjustment are the most serviceable. Immobilization should be prolonged and "uninterrupted,"—that is, the jacket if at long intervals removed for cleansing, etc., should be removed without disturbing the parts, the patient being partially suspended in the swing or in a horizontal position. A patient should never be allowed to sit or stand without support. To enlist home co-operation one may say: "The back is broken for all practical purposes and it needs a long course of splinting." Great care should be taken to make a properly fitting jacket, and then it should be renewed only once or twice a year. Thus, by not requiring to have the jacket renewed frequently, the patient is free to leave for a more favorable climate, or, in the case of an adult, for his home or business. Goldthwait or Tunstall Taylor's kyphotone personally used, the aim being to get a little recession of the deformity when the packet is applied. Seamless stockinet shirting made of Angora wool employed, and to this is sewn padding of Russian felt to cover the spine, the anterior superior iliac spines, and the free ribs. The greatest attention to detail is necessary in fitting a jacket. V. P. Gibney (*Archives of Pædiat.*, Dec., 1902).

The question of the management of abscess is an important one, and opinions differ very widely as to the proper mode of procedure. If the patient is doing well, with a temperature below a hundred, appetite and digestion good, it seems wiser not to interfere with these

abscesses, especially if the disease is between the first and twelfth dorsal vertebra, as the chances for absolute evacuation of all tubercular material and the removal of all diseased foci are not sufficient to warrant interference, which may set up a mixed infection. If the abscess has approached near the surface and seems about to burst, it is wisest, in most instances, to cleanse the skin thoroughly, and apply an antiseptic dressing. When the abscess discharges, this dressing should be changed as frequently as the amount of discharge may require, care being taken to prevent infection of the wound at such times.

The patient should also be compelled to take much more rest than ordinarily, when abscesses are present, as they increase in size much more rapidly if children run about.

If the abscess has become infected with pus-organisms, however, the condition is different, and free incision should be made, either in front or in back, or both, according to the situation of the abscess, and the abscess-cavity freely laid open and washed out with hot Thiersch solution. If the patient's condition and the location of the diseased focus will permit it, exploration of the abscess-cavity should be made, and all carious bone removed. In the lumbar region this is practically simple, but in tuberculosis of the dorsal spine the problem is much more difficult. It may be necessary to resect the head of a rib in order to secure sufficient space to thoroughly explore the spine. Great care should be taken to push the pleura in front of the finger, and not tear it in approaching the body of the vertebra.

The safety of the patient demands that there should be short and direct drainage to the initial point of inflammation; otherwise these abscesses are

apt to form sinuses which run for years, become infected with various micro-organisms, and finally set up amyloid degeneration of the liver and kidneys.

In the upper cervical vertebræ an abscess may point in the back part of the pharynx, and the question may arise whether to open it through the pharyngeal wall or from the outside of the neck. The objections to the first proposition are the difficulty of cleaning the abscess-cavity thoroughly, in the first place; secondly, the impossibility of keeping it from becoming infected later on; and, third, the danger of infection elsewhere from swallowing particles of tubercular *débris*.

In case the abscess is increasing in size and in danger of rupturing into the mouth or of burrowing down the neck, it is better to open it from the outside of the neck. Unless the abscess points elsewhere, it can be well approached by an incision behind the sterno-mastoid, blunt dissection, pushing aside the muscles of the neck, carrying the opening easily to the spine and the abscess. After the latter has been thoroughly evacuated any carious bone that can be reached should be removed and the cavity packed.

In case the abscess presses on the spinal cord and causes paralysis, a question of operation for the relief of pressure comes in; but this is of very doubtful value. The pressure on the cord will probably diminish in a few months' time, on account of the abscess forcing its way outside of the spinal canal, the restoration of function taking place along with removal of pressure from the cord. If the laminae have been removed for the purpose of exposing the abscess and freeing the spinal cord from pressure, the only strong part of the vertebræ at this point has been removed, and, if such an

operation were performed, there would be nothing left to support the spine. In the writer's judgment, therefore, the question of operating on these abscesses is altogether different from the removal of the laminae, in cases of fracture, and should not be undertaken until sufficient lapse of time has shown that all chance of improvement in other ways is improbable.

Very exceptionally, paraplegia in spinal tuberculosis is not caused by the pressure of the products of inflammation on the spinal cord, but by the narrowing of the spinal canal, in consequence of the collapse of the bodies of the vertebræ. But this is of extreme rarity. In these cases laminectomy is advisable. All cases of laminectomy should have the spine supported and protected by a plaster-of-Paris corset for months, just as though the operation had not been done.

The technique of laminectomy is discussed under FRACTURES OF THE SPINE.

Forcible reduction of the deformity consequent on erosion of the front part of the bodies of the vertebræ has recently been revived by Calot. The patient is anæsthetized, placed face downward on a firm table, and traction made on the head and feet either by assistants or by compound pulleys. Pressure is then made on the prominent boss until the spine is forced straight. The patient is then enveloped in a plaster-of-Paris jacket, which extends upward so as to include the neck and head.

This is a revival of a procedure as old as any in medicine, and time enough has not elapsed since its last reintroduction to say whether it has anything to recommend it. A number of cases of sudden death and more of death following soon after the operation have been reported. There is danger of rupturing abscesses

or of re-exciting inflammation by tearing apart old adhesions. Forcible replacement in the hip and knee are often followed by success, but the conditions in these joints are such that firm adhesion of the joint surfaces can be secured. In the spine, after destruction of the anterior part of the bodies of the vertebræ the straightening must cause a gap between the vertebral bodies, and until this is bridged by new bone the spine is in a condition requiring support. Whether or not Nature can fill these gaps with solid bone except in favorable instances must be proved, and time will be necessary before this method can be approved, except in exceptional cases. Gradual reduction by suspension or by horizontal traction supplemented by backward bending of the spine without the use of an anæsthetic is more feasible, and whichever mode of correcting the deformity is adopted the spine must be held in the corrected position until it can be so maintained by the patient; that is, until the disease is cured, which may be a matter of years.

The results of the immediate correction of the deformities of Pott's disease so far reported are as follow: The general condition seems to have been influenced favorably, although there are a number of cases where there was a generalization of the disease. The amelioration might, however, have occurred if the same care and hygiene had been applied without the operation.

The abscesses do not seem to have been influenced either way by the operation. The paraplegic phenomena seem to have been aggravated in some cases, but more frequently been ameliorated or entirely cured. These results have been obtained by other methods of extension or suspension.

The actual correction of the deformity has not been as yet proved to be permanent, and it is doubted if its value can compensate for the nine cases of sudden

death already reported. Wiart (*Rev. de Chir.*, No. 11, '98; Nos. 1 and 2, '99).

Conclusions in regard to the treatment of Pott's disease are as follow: 1. Sufficient experience with the operation of forcible reduction of the deformity in Pott's disease has been accumulated to enable each surgeon to decide whether the procedure is or is not at present justifiable. 2. The theoretical dangers of the operation have not received much support in practice; enough, however, to demand that they be taken into account. 3. Calot reports better results and appears to be more hopeful than anyone else. 4. We should be justified in performing the operation if we could be sure of ultimate good recovery without deformity or with greatly diminished deformity. 5. Satisfactory evidence that the ultimate result will be good is wanting, while the post-mortem findings quoted are anything but reassuring. Galloway (*Canadian Jour. of Med. and Surg.*, Feb., '99).

Forcible reduction personally performed on 9 cases of Pott's disease and 1 of rickets for the purpose of correcting by direct force a spinal deformity. In 3 cases under observation for six months the straight position secured by the application of force has been maintained. In 1 of these the gibbosity formed an angle of 105° , and involved the bodies of seven vertebræ.

In 1 child one month after correction of the deformity an abscess opened at the point of curvature. The spinous process and the lamina of the second dorsal vertebra were resected, and three months later the child was well. One case was followed by death, due to disseminated tuberculosis. The only contraindication to this method is an old and very solid ankylosis. Ghillini (*Revue de Chir.*, Feb. 10, '99).

Continuous, gradually increased over-extension of the spine is a most effective treatment, and at the same time one quite at the command of the general practitioner. The vertebral bodies do not grow again, but the pressure and friction which stimulate the destructive process is removed. The method is especially applicable to children under three

years, as these can be kept in the recumbent position. The apparatus is a rectangular frame of gas-pipe, rather longer and narrower than the patient, and covered with tightly-drawn cotton sheeting except for a six-inch interval at the centre. Thick pads of felt are sewn so as to support the body at each side of the kyphotic area. As soon as the patient has become accustomed to the restraint the bars are from time to time bent upward beneath the kyphosis with the aim of separating the diseased vertebral bodies and obliterating the normal curves of the spine. The child's clothes are made to fit over all, and the arms and legs need no restraint. Once a day the child is removed, is carefully turned face downward upon a large pillow, and the back inspected and powdered. Royal Whitman (*Pædiatrics*, Sept. 1, 1901).

In 39 cases of Pott's disease, the writer found that the application of spinal support was nearly always promptly followed by relief of pain and other acute symptoms, and by improvement in general health. The disease was cured in 33 cases, and in a considerable number the cure was practically perfect as regards health, figure, and function. The results were good as regards deformity in half the cases; 13 cases showed arrest or decrease of deformity. As regards the final amount of deformity, the location of the disease was more important than any other factor, the cervical region being the most favorable, the lumbar next, and the dorsal least. It was necessary to continue spinal support in most cases long after the pathological cure, owing to the tendency to increase of deformity from static conditions. Ankylosis is later, rarer, and less extensive than is usually assumed. Taylor (*The Post-Graduate*, Jan., 1903).

Scoliosis, or Rotary Lateral Curvature.

Rotary lateral curvature of the spine, or scoliosis, is one of the most insidious diseases with which the surgeon comes in contact, and which offers one of the most difficult problems orthopædic surgery is called upon to solve. The age

at which it appears is usually said to be between twelve and fourteen, but this is erroneous, as, in the vast majority of instances, the deformity begins in very early life, but, on account of the absence of pain, it is not detected until well-marked bone-changes have taken place. Another reason for the statement that it occurs in early adolescent life is found in the fact that bone-growth at this time advances with great rapidity, and, in consequence, deformities which have remained quiescent for several years quickly assume marked proportions, on account of the rapid increase in the child's stature. Coincident with this adolescent bone-growth, we have what has been called "adolescent rickets": a disease which, in this country, has received very scant attention, but which is well recognized on the continent of Europe; and the softened condition of the bones then present is responsible, in my opinion, for the very rapid progress which some cases of lateral curvature make in a few months' time. Some observers record instances of lateral curvature which they have observed at birth. In the writer's personal experience the youngest case was six months of age, but the curvature had evidently been present for some time.

Rickets is a very frequent cause of scoliosis, and, as foetal rickets has been observed, it is quite probable that scoliosis may, in a number of instances, be congenital.

The next most frequent cause of scoliosis is anterior poliomyelitis, and many cases are due to this cause which are not usually so recognized, because the extremities, if involved in the original paralysis, have recovered so as not to be noticeably deficient. In some cases of anterior poliomyelitis certain trunk-muscles have been damaged to such an

extent as to impair the equilibrium between the two halves of the body, and so constitute a constant force working steadily toward the distortion of the thorax, which is only overcome with the utmost difficulty. The same condition, involving one or two muscles of the leg, may in time produce a most obstinate talipes, the damaged tissues growing at a slower rate than the healthy ones, and warping the foot, in consequence, toward the weaker side; just so, the spine, growing irregularly by reason of defective nutrition in certain parts, fails to maintain its symmetry; and the problem which confronts the surgeon, of supporting the trunk in as nearly a normal position as possible until the final stage of bone-development has been reached, is a most difficult one to solve.

In some cases scoliosis arises after a severe pneumonia, usually when the latter has been accompanied by pleurisy, especially if the pleurisy has been purulent, the restriction of the movements of the thorax on the affected side being responsible for the impaired bone-growth which follows. The German writers have contended that this variety of scoliosis is not a true scoliosis, and that rotation of the vertebræ does not take place; but a number of cases which have come under observation have convinced the writer that this view is erroneous, and that rotation of the spine always accompanies this variety of scoliosis.

Inequality in the length of the legs, owing to fracture, congenital dislocation, hip disease, and so forth, at times produces a scoliosis, but, unless the shortening of the leg is due to a paralysis, the scoliosis is usually of very limited extent, and can be almost entirely removed by equalizing the length of the legs by means of a thick sole.

In very rare instances scoliosis follows

traumatism, as in one of my cases, where a difficult delivery following a transverse presentation caused separation of the ribs from the sternum, and later on in life a most exaggerated rotary lateral curvature of the spine.

Sometimes scoliosis which progresses rapidly during adolescence is caused by ovarian neuralgia, which sets up reflex contraction of the muscles which control the spine and causes a deformity which rapidly subsides on relief of the pain. In rare cases hysterical contractions may produce a deformity resembling scoliosis so closely as to be mistaken for it.

There is a class of scoliotics in which, apparently, none of these conditions is present to account for the occurrence of the disease, and they are classed as idiopathic. But the number of such cases grows smaller the more closely we study them, and it is my opinion that rickets or some central nervous lesion, analogous to anterior poliomyelitis, is the true cause of these so-called "idiopathic" cases.

Diagnosis.—In no disease is early diagnosis more important than in scoliosis. The clothing should be removed as far as the great trochanters, the skirts being securely pinned around the hips. The undershirt should be removed and hung like a pinafore over the chest. Sufficient time should be allowed to elapse for the patient to become accustomed to her strange surroundings, in order that she may assume her usual attitude, as, at first, it is quite likely she may hold herself more erect than usual. In the vast majority of cases the dorsal convexity is upon the right side, and, for sake of illustration, it will be supposed the case under examination has this variety of scoliosis. Normally, a plumb line from the nape of the neck should pass midway between the scapulæ and through

the intergluteal fold, striking the floor midway between the feet. If there is any deviation from this line, the patient's attitude is not correct. In the ordinary scoliosis the right scapula is

Quite frequently there will be noticed an inequality in the heights of the shoulders, the shoulder on the side of the dorsal concavity being the lower. The hips very often show an apparent differ-



Fig. 2.—Lateral curvature of spine, with marked rotation. (*R. H. Sayre.*)

farther from the median line than the left, the right hand hangs farther away from the hips than the left, and there is a larger space between the right elbow and the waist than between the opposite side of the waist and the left elbow.

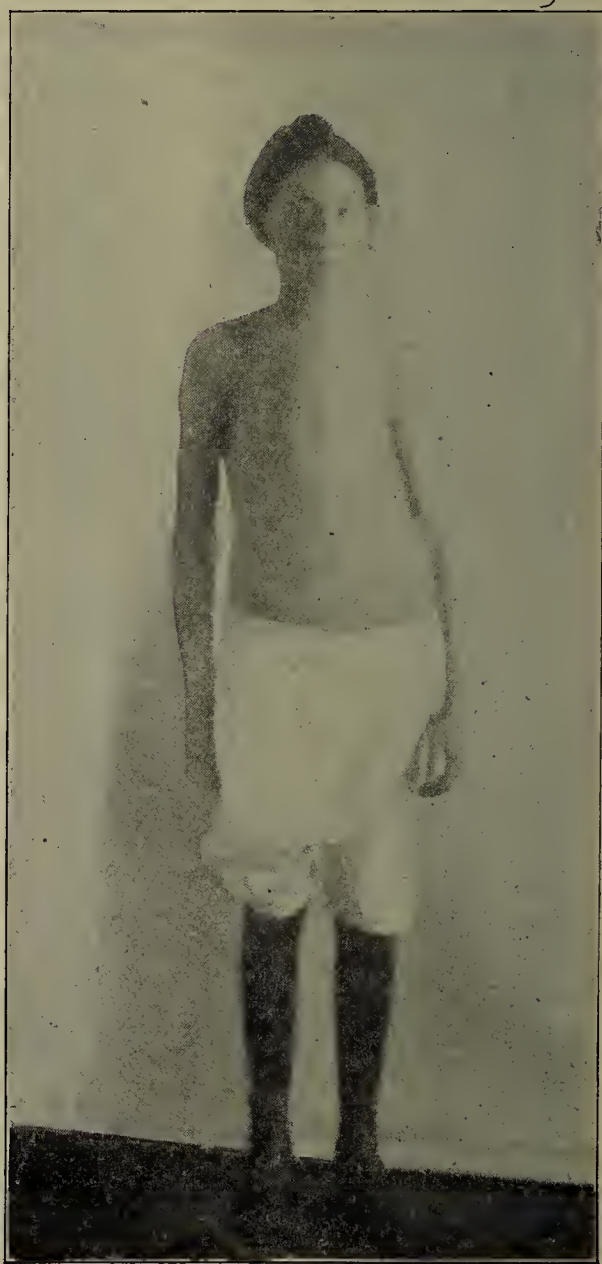


Fig. 3.—Lateral curvature of spine, with marked rotation. (*R. H. Sayre.*)

ence in height, the hip on the side of the concavity appearing to be decidedly higher than its fellow. This may actually be the case on account of difference in the length of the legs, but usually the difference is only apparent, and

caused by the sharp deviation of the trunk from the median line. Inspection from the front will often show the inequality of the hips to a greater extent than when viewed from the back. It will also be found that the breast on the side of the dorsal convexity is almost always smaller than its fellow. There is also, usually, a difference in their distance from the umbilicus, the one on the side of the dorsal convexity being higher up. A large number of cases of scoliosis show also great flattening of the plantar arch, and, at times, have very pronounced flat-foot. This point should always be investigated, and calls for treatment, as it is impossible to preserve an erect carriage of the trunk if the feet upon which the trunk rests are not in good condition.

The patient should now bend forward, keeping the legs straight, and letting the hands hang perpendicularly toward the floor. In this position the scapulæ are drawn forward, the ribs left better exposed to view than when the patient is upright, and small amounts of rotation of the spine can thus be made out, which might escape observation if the patient were examined in the upright posture only.

It might be supposed that conditions that have such radical differences in their pathology as scoliosis and Pott's disease could not be confounded, but lateral deviation of the spinal column occurs in the latter disease, and at times the deformity so closely resembles a true scoliosis as to deceive even those of large experience. The occurrence of muscular spasm, associated with pain on movement or with elevation of temperature, should cause a provisional diagnosis of spinal tuberculosis. Rest and protection of the spine should be tried and gymnastics rigorously prohibited.

Records should be kept of the condition of the patient, as it is impossible, otherwise, to judge of the progress of a case. The age, weight, height, circumference of the chest, and length of the limbs certainly should be noted. A photograph also should be taken with both front and rear views, and at times a profile. With the patient lying prone upon the floor or some hard surface, the contour of the back should be taken at various points, by means of a flexible lead tape, and the tracing transferred to a permanent record. In taking subsequent tracings, or rephotographing the patient, care should be taken to reproduce as nearly as possible the same conditions as those under which the first photographs or measurements were made. Otherwise there is great danger of the physician deceiving himself in regard to the progress of the case, as it is quite easy to place the patient in different positions on the same day, and get very different results from either the photograph or tracing.

The apparatus of Beely, of Berlin, and the Zander machine for taking diagrams of the thorax are very useful methods of recording the results of such observations, but the majority of practitioners will not find time for their use.

Pathology.—The pathology of incipient cases of scoliosis is deduced chiefly from examination of subjects who have died in advanced stages of the disease, as it itself is not fatal, and opportunities to examine incipient cases rarely present themselves. It is probable that the early changes are in the intervertebral disks, which become compressed on one side, and so destroy the erect posture of the spine. In consequence of the bending of the spine away from the median line, compensating curves occur in the opposite direction at those points of

the spine remote from the original curvature, in order to restore, as far as possible, the equilibrium of the trunk. From the fact that the spinous processes are fastened more or less securely together by the interspinous ligaments, lateral flexion of the spine is always accompanied by more or less rotation of the vertebræ on themselves, and this normal rotation, which becomes very much accentuated in scoliosis, is the

tebræ are also very frequently wedge-shaped, one side being twice the height of the other, and not infrequently large osteophytes are thrown out which at times firmly join several vertebræ together, producing an ankylosis, and at other times encroach so much upon the intervertebral foramina as to cause very painful neuralgias.

In these advanced cases the ribs also participate in the deformity, the angles



Fig. 4.—Method of making pressure on projecting ribs to correct rotation in lateral curvature of the spine. (*R. H. Sayre.*)

most difficult factor with which we are called upon to deal.

In the more advanced cases of scoliosis the deformity involves not only the intervertebral substance, but the entire vertebræ. The bodies of the vertebræ show unequal development of their two component halves, and the spinous processes, instead of projecting straight to the rear of the body, bend more or less sharply to one side or the other, according to the curve. The bodies of the ver-

of the ribs on the side of the convexity being very much more accentuated than is normal, while the ribs themselves often droop so far toward the pelvis as to pass inside of its brim. The ribs may occasionally overlap each other, giving rise to great pain, and even, at times, to periostitis.

Not infrequently these bone-changes extend to the pelvis itself, and in many cases of lateral curvature the typical rachitic pelvis is readily distinguished.

The rotation of the front part of the body of the vertebræ is toward the side on which the convexity exists, and may be so great that a line passed through the spinous process and central part of the body of a cervical vertebra may be parallel with one through the fifth lumbar, and yet at right angles to a line passing in a similar manner through the middorsal region.

Treatment.—Treatment consists, first, in removing any defect which may exist, which predisposes the patient toward a scoliosis. If the case be one due to paralysis, and it is not possible for the patient voluntarily to hold the body in the upright posture, artificial means must be employed to maintain it in an erect position. The same is true in some cases of rachitic scoliosis which require support, exactly as cases of bow-leg or knock-knee require support until the soft stage of rickets has passed and the bones have become hard once more.

If the patient is distorted to any appreciable extent, force must be used to press the bones back toward the straight line as far as possible. In doing this, both longitudinal traction and rotation are necessary. The most convenient method of employing longitudinal traction is for the patient to suspend herself partially by means of a head-collar fastened to a cross-bar and hanging from a beam by a compound pulley, the end of the pulley-rope being held by the patient, who, keeping her arms extended to their fullest extent, lifts herself by degrees, hand over hand, until her heels are clear of the floor, thus suspending almost the entire weight of the body on her head and arms. The hips should now be grasped, either in a clamp or between the surgeon's knees, and the trunk twisted around its longitudinal axis, so as to reduce the deformity. In

some cases the patient is lain prone on a firm couch, and traction made on the head and feet by means of pulleys. The surgeon then presses with great force on the projecting ribs, endeavoring to



Fig. 5. — Palm of hand against projecting ribs and hand of hollow side across top of head. Endeavors to bulge out hollow side. (R. H. Sayre.)

force them toward the normal. (See Fig. 4.) In correcting rotations of this sort, attention must be paid to the anatomical relation of the ribs and vertebræ, pressure being directed so as to rotate

the vertebræ around the longitudinal axis in the proper direction, mere lateral pressure against the side tending to increase rather than decrease the angular deformity of the ribs.

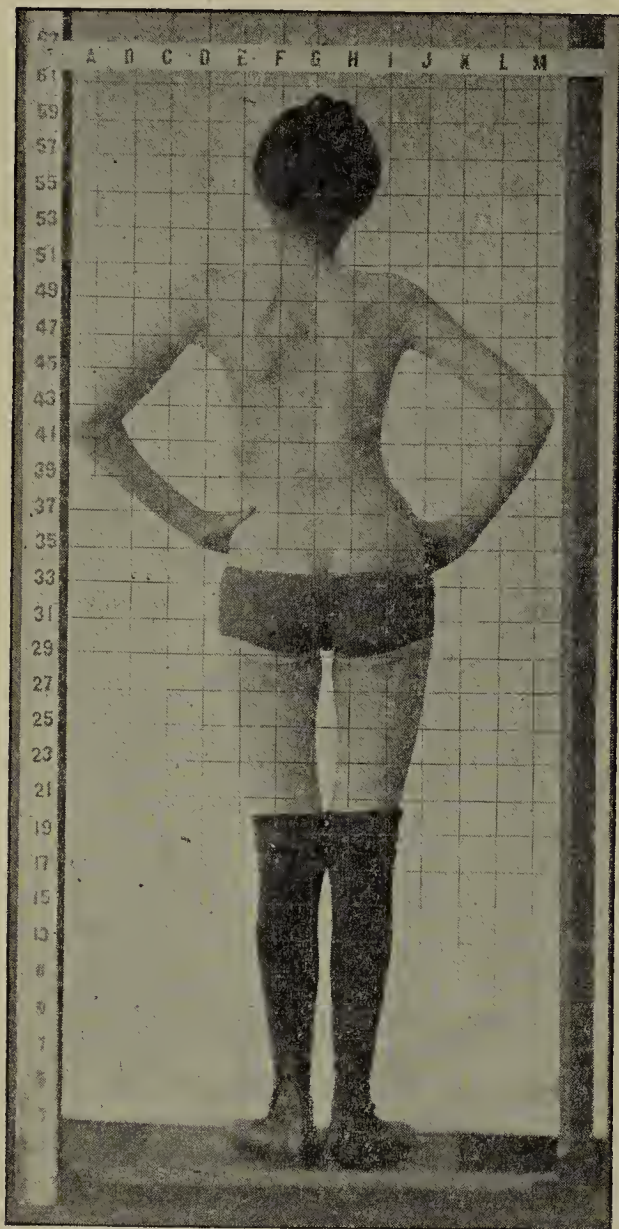


Fig. 6.—Standing, hands on hips, patient endeavors to bulge out the hollow side and simultaneously to untwist the rotation. (*R. H. Sayre.*)

In very severe cases the patient should be anæsthetized, and forcible correction of the vertebræ employed, as described above, a plaster-of-Paris jacket being applied to the patient while in the prone and stretched position, the frame on

which she rests being moved from the padded couch on which traction was made, and supported by its extremities alone, in order that the plaster jacket may be more easily applied.

In ordinary cases, where a plaster jacket is necessary, it is much more readily applied in the upright position than prone.

In applying plaster-of-Paris bandages in cases of lateral curvature, a shirt of double length is used, pads are placed inside the shirt over the mammæ and outside the shirt over the iliac crests, and a strip of tin two inches wide is placed next the skin from the sternum to the pubes, on which to cut off the plaster; and, instead of being suspended by the head and axillæ, the patient suspends herself by pulling on the free end of the rope which passes from the head-swing over the pulley, while she keeps the arms outstretched, the upper hand being on the concave side. The surgeon, sitting behind the patient, applies the bandages as in a case of Pott's disease. As soon as the plaster is set, which should be the case by the time the corset is finished, it is split open down the front and removed while the patient is still suspended. A thin slice is then taken from each edge of the slit and the corset held together by a roller bandage and dried. When dry, the next day, it is put on the patient while again self-suspended, and fastened by a roller bandage; then trimmed out under the arms and above the thighs until comfortable, and removed. The extra length of shirt is then reversed over the jacket and sewed to itself, covering in all the plaster, and lacings are sewed on in front. The latter are sewed through and through the plaster of Paris, a shoemaker's awl being used to make the holes through which the needle passes.

If the patient is very heavy it is well to reinforce the strength of the corset by putting a thin strip of steel under the leather which holds the hooks.

Plaster-of-Paris jackets should not be



Fig. 7.—After forcible correction with plaster-of-Paris jacket and gymnastics. (*R. H. Sayre.*)

covered with shellac or varnish, as it renders them impervious to the insensible perspiration, and so makes them hot, unhealthy, and uncomfortable.

If the case is very badly deformed, it is expedient to put padding inside of the

shirt when it is reversed, in order to make the corset as symmetrical as possible, and thus avoid the necessity of padding the clothes.

The corset having been made while the patient is stretched out, it should always be applied to the patient in this position. For this purpose, the patient is provided with a pulley-wheel and

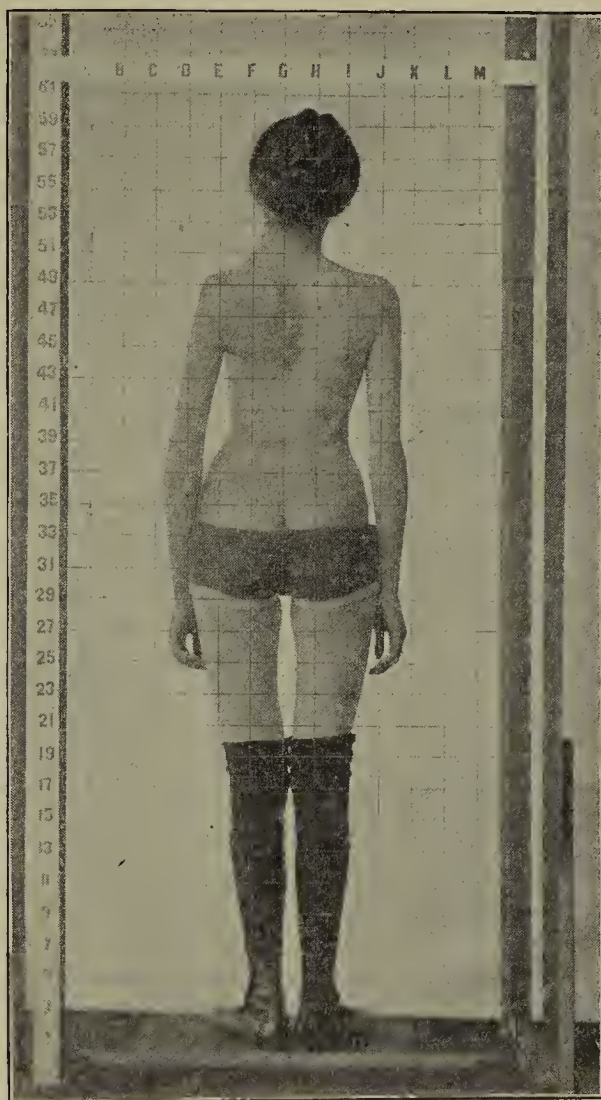


Fig. 8.—After forcible correction with plaster-of-Paris jacket and gymnastics. (*R. H. Sayre.*)

head-swing at home, by which she can suspend herself in the morning, while the corset is applied by some member of the family, and retained in position by lacings joining the hooks on the front of the jacket. The lacing should pass first

around the two central hooks at the waist, and then run down to the bottom, be reversed, and pass up again to the top. Applied in this manner, the corset fits better than if the lacing is begun at either end. It is a mistake to cut corsets down in two places, as I have frequently seen done, neither should it be made so stiff as to render it impossible to remove it unless it is thus cut in two pieces.

If support is to be used, a plaster-of-Paris jacket is the most useful, in my experience. The various forms of elastic supporting braces fail to accomplish that which they were designed to effect, and that they must fail to do so is readily seen by anyone who will contemplate the great mechanical difficulties which have to be met in controlling the motions of the large number of joints which compose the spine.

If a patient requires a permanent support on account of very marked deformity or paralysis, a wood jacket is somewhat lighter than one made of plaster of Paris, although it will be found hotter. The wire corset is cooler than the wood, but not so light, and both require much more time and trouble to manufacture than does the plaster of Paris. The same is also true of the aluminum corset, while celluloid forms a very pretty support, but one so intensely hot as rarely to be endured.

The mechanical support for lateral curvature of the spine should be as rigid as an oak. It should be porous and durable. The plaster-of-Paris corset comes the nearest to these requirements of any of the cheap dressings. Poroplastic felt, leather, rawhide, and paper should never be used for spinal supports. Celluloid is worse, and the wood corset is absolutely worthless. The aluminium corset is the most perfect support ever devised. The patient can go in bathing without taking off the support.

To change the form of the thorax,

which will aid materially in somewhat alleviating the curves, breathing exercises which expand the chest, elevating the ribs, which applies a force direct to the spinal column, assist materially. Exercises should be performed while the corset is on. It is wrong to take it off. The physiological curve can be overcome only by constant support and muscular development, and the pathological lateral curve by preventing the patient from assuming the erect position without his corset. Light gymnastics are far preferable to heavy. Heavy gymnastics develop muscle, but no quicker or surer than light gymnastics. Muscles developed by heavy gymnastics undergo rapid degeneration when the gymnastics are stopped.

An ordinary aluminium corset weighs from one to two pounds, depending upon the size. To prevent cracking and to protect it from perspiration, it is covered with a water-proof enamel, which is applied by heat.

The steps of its construction: Make a plaster form of the body; send this form to the foundry and have a cast-iron anvil made; polish this, and then at a certain temperature the workmen will bend on to it two sheets of aluminium representing the two lateral halves. The frequent heating and hammering, together with the cylindrical shape, make the corset almost as strong as steel. The two halves are hinged in the back and closed with automatic clasps in front, which stop at any notch to accommodate the corset to the body before and after eating. This corset completes my armamentarium in cases requiring spinal supports, viz.:—

1. Plaster-of-Paris corsets for acute Pott's disease.
2. The Hessian corset for mild forms of lateral curvature, particularly in girls.
3. The aluminium corset for permanent bracing.

A. M. Phelps (N. Y. Med. Jour., Jan. 5, 1901).

The following method has given satisfactory results. The patient is placed on a special frame and the spinal deformity is reduced as much as possible. A plaster jacket is then applied. Such corrective jackets are

worn for two or three weeks and renewed as seems desirable. At the end of this period the patient is furnished with a retentive jacket made of leather or celluloid. This last jacket may be dispensed with at the end of one or two years. The special features of the author's method are two: (1) The patient lies on the frame in the prone position with the thighs flexed at right angles to the body. (2) The deformity of the spine is overcome by lateral pressure. No tension is placed upon the spinal column. R. W. Lovett (Boston Med & Surg. Jour., Mar. 17, 1904).

The key to success in all cases of lateral curvature, however, lies in developing the patient's own ability to hold the body in as improved a position as possible, and he who contents himself with any kind of support has but half-done his duty toward himself and his patient. To be effective, exercise must be so carried on that the patient learns instinctively to help herself at all times during the twenty-four hours, and not merely to preserve an erect carriage while in the doctor's office. Any system which fails to arouse the patient's interest and stimulate her desire to improve herself as far as possible by constant, unremitting effort will fall short of attaining the result sought for.

The following set of exercises will be found useful for the majority of cases of lateral curvature, but the success which attends their application will be dependent on the amount of enthusiasm with which the individual patient can be imbued.

While self-suspension, in the manner indicated, is a most useful means of diminishing the curvature of the spine, it is not practicable for a patient to suspend herself for a long period of time; and it is wise to supplement it by suspension by means of a weight and pulley

attached to a chin-piece, which is fastened to the patient's head while she lies on her back on an inclined plane which is slightly convex.

In correcting the rotation, which, as before remarked, is a vastly more prominent element in the production of deformity than the lateral deviation of the spine, great benefit is derived from placing the patient face downward upon the floor or a firm table covered with a thick rug, while the physician makes strong pressure upon the projecting scapula, pushing in a direction forward and away from the central line of the body, so as to rotate the vertebræ toward the median line. In some cases the patient is allowed to lie for half an hour in this position with a sand-bag weighing twenty or thirty pounds resting upon the shoulder, if it can be placed so that the weight falls in the proper direction.

In beginning the exercises a mat or thick shawl is laid on the floor and the patient lies prone, the arms at right angles to the trunk, palms down, face turned to the convex side, and the back as straight as possible. The patient supinates the hands, throws the scapulæ well back, raises the hands from the floor, and lifts the trunk, while the surgeon holds the feet down. This is repeated three times; later on it can be done oftener. The breath should not be held during any of these exercises, but the patient should breathe naturally. If necessary to secure this, make them count aloud while exercising.

With the hands behind the head, the patient raises the elbows from the floor, and raises the trunk as before, the feet being held by the surgeon.

With the hands behind the head and the elbows raised, the body is swayed toward the convex side, the patient trying to "pucker in" the bulging ribs and

not to bend in the lumbar concavity. The feet are fixed as before.

With the arm on the side of the convexity under the body, the other arm over the head, the heels fixed, the patient raises the trunk from the floor.

Sometimes the arm on the side of the concavity is put on the opposite buttock, while the patient raises the trunk. Sometimes the arm on the convex side is put on the buttock, and in cases of marked lordosis, with great stooping of the shoulders, both hands are put on the buttocks while the patient raises the trunk.

The patient now lies on the back, arms at the sides, palms up, and lifts first one foot in the air, while the surgeon makes resistance graduated to the patient's power; repeated, say, five times. The same is done with the other foot, and then with both. The feet are next separated and then brought together once more while the surgeon resists. Each leg then describes a circle, first from within out, then from without in.

If there is special weakness at the ankles, with a tendency to flat-foot, the patient flexes the foot and extends it against resistance, and turns the sole of the foot toward its neighbor, the surgeon resisting; and it is then forcibly everted again by the surgeon, the patient resisting.

The patient now lifts the arms from the sides, passing perpendicularly to the floor till they are stretched as far beyond the head as possible, and then, going at right angles to the trunk and parallel with the floor, returns them to the sides, palms up.

When the heels are held, the patient rises to the sitting position, hands at the sides; then she rises from the floor with the hands behind the head and the elbows at right angles to the trunk.

The patient now stands with the heels together, toes turned slightly out, hands behind the head, elbows at right angles to the trunk; then rises on tip-toe, bends the knees and hips, keeping the back as straight and erect as possible, and rises up once more. With the arm on the concave side high above the head, the arm on the convex side at right angles to the body, she rises on tip-toe, bends the hips, knees, and ankles so as to squat, then rises and stands. All this time care must be taken to push the body as straight as possible, and gradually to educate the patient to hold it so without wriggling during these movements.

Let the patient practice walking in these positions, both on the flat foot and tiptoe, and also stepping high, as if walking upstairs. With the palm of the patient's hand on the convex side against the ribs, pushing them in, the other hand on the concave side, she pushes a slight weight up in the air, while the body swings so as to straighten out the curves.

The surgeon should sit behind the patient, fix her thighs with his knees, while she holds both arms above the head and bows toward the floor, keeping her knees stiff while the surgeon keeps her ribs as straight as possible with his hands.

With the arm on the concave side across the top of the head, and the arm on the convex side around in front of the abdomen, the patient bends to the convex side through the ribs and *not* through the waist.

The patient sitting with the back toward the surgeon, the latter pushes one hand against the most projecting part of the convexity, and, with the other hand passed under the shoulder of the concave side, straightens out the curve as much as possible, the hand on

the "bulge" acting as a fulcrum in straightening the curve.

The patient sits on a stool in front of the surgeon, who fixes the pelvis with his knees. The patient then twists the projecting shoulder to the front while the surgeon holds the elbows, which are at right angles to the trunk, the hands being behind the head, and makes resistance. In the same position the patient swings forward and back, swinging through the hips, keeping the back stiff, and not bending in the waist.

The patient pushes in the ribs on the convex side with the hand, and pushes up with the hand on the concave side, the same as when standing. She also lifts the arm on the concave side up at right angles with the body while holding a weight.

In cases of round shoulders, wind-mill motions of both arms and to-and-fro movements of the head against resistance are advisable.

The patient lies prone on the couch, all the body above the waist projecting from it, while the surgeon holds the heels. With the hands behind the head, the elbows thrown back, the body is bent toward the floor, then raised up; later on, resistance is made by the surgeon. The patient lies on the concave side and rises up laterally. The patient lies with the convexity on the edge of the couch, and hangs off as far and as long as possible.

The patient stands bent forward as if playing leap-frog, her hands on a chair, while the surgeon, with one hand under the shoulder on the convex side and one hand on the projecting ribs, corrects the rotation. It is advisable to steady the patient with the knee while doing this.

Spinal Localization.

In localizing lesions of the spinal cord the latter is regarded as being made up

of a number of segments, each named with reference to the nerves which have their origin from this part of the cord; thus the first dorsal segment is that from which the first pair of dorsal nerves take their origin. It must be recollected that these nerves do not issue from the spinal canal directly opposite the segment from which they arise, but lower down, the distance below varying in different parts of the spine, but becoming greater the lower down the spine the injury is located.

We judge of the location of the injury in the cord, first, by the motor paralysis that is present; second, by the cutaneous anæsthesia; and, third, by the condition of the reflexes.

In the accompanying table from Keen are shown the various spinal segments, the muscles innervated by each, and the part of the body supplied by sensation, as well as the reflexes (next page).

Tumors of the Spinal Cord.

Tumors of the spinal cord were considered beyond the surgeon's reach till Gowers and Horsley in 1887 reported a successful case in which the diagnosis had been made from nerve symptoms without the presence of any external tumor.

These tumors may be extradural or intradural. There have been reported lipoma, osteoma, fibroma, sarcoma, myxoma, psammoma, carcinoma, tubercle, parasitic cysts, callus from old fracture, and connective-tissue formations. Gummata are usually capable of removal by constitutional treatment. Carcinoma is usually secondary to carcinoma elsewhere and generally inoperable.

Study of tumors of the spinal cord, based upon fifty-six personal observations and the published cases. Of the tumors involving the spinal cord 57.7 originated in the vertebræ, and 42.3 were of intravertebral origin. Of the whole

LOCALIZATION OF THE FUNCTIONS OF THE SEGMENTS OF THE SPINAL CORD. (KEEN.)

SEGMENT.	MUSCLES.	REFLEX.	SENSATION.
Second and third Cervical.	<ul style="list-style-type: none"> Sterno-mastoid. Trapezius. Scaleni and neck. Diaphragm. 	<i>Hypochondrium?</i> (third to fourth cervical). Sudden inspiration produced by sudden pressure beneath the lower border of ribs.	Back of neck and of head to vertex. (Occipitalis major and minor, auricularis magnus, superficialis colli, and supraclavicular.)
Fourth Cervical.	<ul style="list-style-type: none"> Diaphragm. Deltoid. Biceps. Coraco-brachialis. Supinator longus. Rhomboid. Supraspinatus and infraspinatus. 	<i>Pupillary</i> (fourth cervical to second dorsal). Dilatation of the pupil produced by irritation of the neck.	Neck. Shoulder, anterior surface. Outer arm. (Supraclavicular circumflex, musculo-cutaneous, or external cutaneous.)
Fifth Cervical.	<ul style="list-style-type: none"> Deltoid. Biceps. Coraco-brachialis. Brachialis anticus. Supinator longus. Supinator brevis. Deep muscles of shoulder-blade. Rhomboid. Teres minor. Pectoralis (clavicular part). Serratus magnus. 	<p><i>Scapular</i> (fifth cervical to first dorsal). Irritation of skin over the scapula produces contraction of scapular muscles.</p> <p><i>Supinator longus</i> (fourth to fifth cervical). Tapping the tendon of the supinator longus produces flexion of forearm.</p>	Back of shoulder and arm. Outer side of arm and forearm to wrist. (Supraclavicular circumflex, musculo-cutaneous, or external cutaneous, internal cutaneous, radial.)
Sixth Cervical.	<ul style="list-style-type: none"> Biceps. Brachialis anticus. Subscapular. Pectoralis (clavicular part). Serratus magnus. Triceps. Extensors of wrist and fingers. Pronators. 	<p><i>Triceps</i> (sixth to seventh cervical). Tapping elbow-tendon produces extension of forearm.</p> <p><i>Posterior wrist</i> (sixth to eighth cervical). Tapping tendons causes extension of hand.</p>	Outer side and front of forearm. Back of hand, radial distribution. (Chiefly musculo-cutaneous, or external cutaneous, internal cutaneous.)
Seventh Cervical.	<ul style="list-style-type: none"> Triceps (long head). Extensors of wrist and fingers. Pronators of wrist. Flexors of wrist. Subscapular. Pectoralis (costal part). Serratus magnus. Latissimus dorsi. Teres major. 	<p><i>Anterior wrist</i> (seventh to eighth cervical). Tapping anterior tendon causes flexion of hand.</p> <p><i>Palmar</i> (seventh cervical to first dorsal). Stroking palm causes closure of fingers.</p>	Radial distribution in hand. Median distribution in palm, thumb, index, and one-half middle finger. (Musculo-cutaneous, or external cutaneous, internal cutaneous, radial, median.)
Eighth Cervical.	<ul style="list-style-type: none"> Triceps (long head). Flexors of wrist and fingers. Intrinsic hand-muscles. 		Ulnar area of hand, back, and palm. Inner border of forearm. (Internal cutaneous, ulnar.)
First Dorsal.	<ul style="list-style-type: none"> Extensors of thumb. Intrinsic hand-muscles. Thenar and hypothenar muscles. 		Chiefly inner side of forearm and arm to near axilla. (Chiefly internal cutaneous and nerve of Wrisberg or lesser internal cutaneous.)

LOCALIZATION OF THE FUNCTIONS OF THE SEGMENTS OF THE SPINAL CORD (*concluded*).

SEGMENT.	MUSCLES.	REFLEX.	SENSATION.
Second Dorsal.			Inner side of arm near and in axilla. (Intercostohumeral.)
Second to twelfth Dorsal.	Muscles of back and abdomen. Erectores spinæ.	<i>Epigastric</i> (fourth to seventh dorsal). Tickling mammary region causes retraction of the epigastrium. <i>Abdominal</i> (seventh to eleventh dorsal). Stroking side of abdomen causes retraction of belly.	Skin of chest and abdomen in bands running around and downward, corresponding to spinal nerves upper gluteal region. (Intercostals and dorsal posterior nerves.)
First Lumbar.	Ilio-psoas. Rectus. Sartorius.	<i>Cremasteric</i> (first to third lumbar). Stroking inner side of thigh causes retraction of testicle.	Skin over groin and front of scrotum. (Ilio-hypogastric, ilio-inguinal.)
Second Lumbar.	Ilio-psoas. Sartorius. Quadriceps femoris.		Outer side of thigh. (Genito-crural, external cutaneous.)
Third Lumbar.	Quadriceps femoris. Anterior part of biceps. Inward rotators of thigh. Abductors of thigh.	<i>Patellar</i> (third to fourth lumbar). Striking patellar tendon causes extension of leg.	Front of thigh. (Middle cutaneous, internal cutaneous, long saphenous, obturator.)
Fourth Lumbar.	Abductors of thigh. Adductors of thigh. Flexors of knee. Tibialis anticus. Peroneus longus.	<i>Gluteal</i> (fourth to fifth lumbar). Stroking buttock causes dimpling in fold of buttock.	Inner side of thigh, leg, and foot. (Internal cutaneous, long saphenous, obturator.)
Fifth Lumbar.	Outward rotators of thigh. Flexors of knee. Flexors of ankle. Peronei. Extensors of toes.	<i>Achilles tendon</i> (fifth lumbar to first sacral). Over-extension causes rapid flexion of ankle, called ankle-clonus.	Back and outer side of leg; dorsum of foot. (External popliteal, external saphenous, musculo-cutaneous, plantar.)
First and second Sacral.	Flexors of ankle. Extensors of ankle. Long flexor of toes. Intrinsic foot-muscles.	<i>Plantar</i> (fifth lumbar to second sacral). Tickling sole of foot causes flexion of toes and retraction of leg.	Back and outer side of leg, sole, dorsum of foot. (Same as fifth lumbar.)
Third, fourth, and fifth Sacral.	Gluteus maximus. Perineal. Muscles of bladder, rectum, and external genitals.	Vesical centres. Anal centres.	Back of thighs, anus, perineum, external genitals. (Small sciatic, pudic, inferior hæmorrhoidal, inferior pudic.)
Fifth Sacral and Coccygeal.	Coccygeus muscle.		Skin about the anus and coccyx. (Coccygeal.)

number, about one-fifth were intramedullary, and about one-tenth grew from the membranes, nerve-roots, and cauda equina. In 400 cases growing within the spinal canal, and not from the vertebræ, the following was the order of frequency: Sarcoma, 107; tubercle, 64; echinococcus, 44; fibroma and neurofibroma, 33; gumma, 28; glioma, 20. In 115 of the 400 cases the tumors were multiple. In about one-third of all the cases operation was possible. The fact that primary tumors of the cord and meninges do not give rise to metastases was confirmed. In children under ten years the most common tumors were tubercle, lipoma, and sarcoma. From the tenth to the fortieth years, tubercle, glioma, sarcoma, and hydatid cysts were the most common growths. In later life gumma was the most common intramedullary tumor. Injury is thought to be an important etiological factor. Fischer (*Beit. f. Klin. d. Rückenmarks u. Wirbeltumoren*, '98).

Symptoms.—The symptoms will vary according to the location of the tumor; they are pain, motor paralysis, and sensory paralysis.

Pain is usually the earliest symptom and is often mistaken for rheumatism, but should be differentiated from this by not affecting various joints, and by its gradual onset. Muscular spasm is associated with many cases. In a large percentage we find anæsthesia on the side opposite to the tumor, while hyperæsthesia is present on the same side as the growth, associated with ataxia, motor paralysis, and exaggerated reflexes on account of the fact that the motor and sensory fibres of the cord cross at different levels. The pain is referred to a level below the tumor, and care should be taken to explore the cord higher up than the tumor was supposed to exist in case it is not discovered at this point. There is apt to be rigidity of the spine partly from pain and partly from muscle-spasm.

Paralysis may be caused by pressure simply or from myelitis, hæmorrhage into the cord, or infiltration of the tumor, and is usually gradual in its onset. Motor paralysis progresses from above downward, while the paralysis of sensation begins at the feet and ascends. The reflexes are exaggerated in the outset and diminish later on. Retention and incontinence of urine take place, accompanied by cystitis, paralysis of the rectum, and bed-sores, and the usual chain of symptoms of cord involvement come on when the paralysis has become more pronounced. The diagnosis of tumor must be based on involvement of the spinal cord with the exclusion of other cord diseases, the site being diagnosticated by means of the symptoms exhibited by various parts of the body, keeping always in mind the possibility of the tumor being multiple.

The two most difficult features in the diagnosis are whether the tumor is intradural or extradural, and at what segment of the spinal cord it is situated. The consensus of opinion seems to be that the location of any tumor in the cord is from two to four inches above the uppermost limits of the anæsthesia, and more often the latter figure than the former is correct. In attempting to estimate the value of pain as a localizing factor we are often confused by the widespread area over which the pain exists. In some instances, however, the distribution of the pain is very suggestive of the location of the tumor. The most common tumors of the spinal cord are those of the dura; those growing within the dura are nearly twice as common as those growing without. The favorite location for spinal-cord tumor is in the dorsal region—the lower and upper end. In the seventy cases analyzed, including 3 personal cases, 35 were of the dorsal region, 15 of the cervical, 13 of the lumbar and sacral, and 6 of widespread distribution. Collins (*Medical Record*, Dec. 6, 1902).

Except in the case of gummata, the prognosis is fatal without operation, and the latter should therefore be undertaken unless the condition of the patient is such as to render it hopeless even if the tumor is located and found capable of removal.

Three original cases of morbid growths of the spinal cord treated by surgical operation are noted; also a table of 33 other cases of a like kind collected from various sources. In 10, perhaps 12, of these cases the operation seems to have hastened death; in 9 cases the surgical treatment made little difference in the progress of the case. In 10 cases the operative treatment is reported to have led to recovery; but in 2 of these cases the records are not sufficiently perfect to allow of verification of the statement. Putnam and Warren (Amer. Jour. Med. Sci., Oct., '99).

Spina Bifida.

Spina bifida is a congenital malformation of the spine analogous to and often associated with harelip, cleft palate, and bifid uvula, which is due to defective development of the ovum. A vertebra develops from four primary centres: two for the body, which make their appearance at the eighth week, and one for each lamina, appearing at the sixth week. If the laminae fail to unite in the median line, a gap in the bony structure of the spine exists through which the cord and its membranes may protrude, forming a tumor on the back. Occasionally, but very rarely, there is a failure to unite between the two halves of the body of a vertebra and in this way an anterior spina bifida may result.

The gap caused by the failure of the laminae to unite may be small and confined to one vertebra, or may involve almost the entire width of the laminae and extend the entire length of the spinal column.

Now and then there is a defect in one

or more vertebræ without protrusion of the membranes or cord and we have what is called *spina bifida occulta*, as there is no tumor to be seen. This condition is apt to be overlooked, but its existence should be suspected in persons with congenital disturbances of function of the lower limbs, especially if associated with imperfect control of the sphincters. If there is a hairy patch on the spine, the probabilities of a *spina bifida occulta* being present are much increased.

In the ordinary spina bifida the contents of the spinal canal protruding through the gaping laminae form a tumor in the median line of the back which may vary in size from a hardly appreciable button to a mass as large as a foot-ball. At times there is a narrow constricted base with a well-marked pedicle and at others the tumor lies flat on the back. This tumor may be covered with tough, thick skin, usually, however, the contents of the tumor press upon the skin until it is changed to a thin, translucent envelope through which the contents of the sac may be seen with more or less distinctness. The fluid which fills the sac is the same in character as the cerebro-spinal fluid. Often spina bifida is associated with hydrocephalus, and sometimes, in such cases, if pressure be made on the tumor a sense of fullness will be communicated to the fingers held against the anterior fontanelle. The action of gravitation can also be seen at times, the child's head swelling when it is laid down and the spinal tumor growing larger when the child is placed upright.

There are three recognized classes of spina bifida, divided according to the character of the contents of the sac. If the membranes of the cord alone protrude through the opening in the arches,

then the tumor is called a *meningocoele*. Should both the membranes and the cord, with its appertaining nerves, protrude, we have a *meningomyelocoele*. Should the central canal of the cord become distended with fluid and push before it both membranes and cord, we have a *syringomyelocoele*, or a condition known as *syringomyelia*.

It is by no means easy to make an absolute diagnosis as to the kind of tumor that presents except in the rare cases where the sac is so extremely thin that the outlines of the nerves can be made out. The failure to see nerve-roots through the sac-wall, however, by no means proves that they are not there, and it is usually impossible to say this positively before operation; but if there is marked involvement of the sphincters, with paralysis and atrophy of the lower extremities, it is almost certain that the case is a *meningomyelocoele*.

Prognosis.—The prognosis will vary in different cases. At times the tumor is of small size and the child's general condition is good; but in other cases there is a great defect in the tone, the tumor is enormous, the lower extremities are paralyzed, there is little or no control over the sphincters, and frequently the intelligence is almost lacking. Some of these very bad cases fortunately die soon after birth.

Treatment.—Treatment will vary with the conditions that present themselves. If the tumor is small and covered by strong, thick skin, it may in time diminish in size, the child's condition may improve, and nothing be required but protection from traumatism by a shield of metal or celluloid. If the skin is thin, it is sometimes found useful to paint it frequently with tannin collodion, which serves to thicken and toughen it.

In case the child does not improve in

the control of its muscles, or if the skin covering the sac grows so thin as to threaten rupture, operative interference should be tried. This may consist either in aspirating the fluid and injecting something to cause contraction of the sac or in excising the sac and closing the gap as well as practicable.

In 1848 Brainard, of Chicago, reported a series of cases in which he had successfully injected a watery solution of iodine and iodide of potassium. Later on Morton advocated the use of an injection in which glycerin was used as being less apt than either water or alcohol to permeate the cerebro-spinal fluid with rapidity and so cause convulsions. Morton's fluid consists of iodine, gr. x; iodide of potassium, gr. xxx; and glycerin, f3j. With an hypodermic needle passed through the healthy skin into the sac a half-drachm or so of fluid is drawn off and an equal amount of the iodoglycerin fluid injected. Pressure is applied during the operation to prevent, if possible, the fluid from entering the spinal canal. The puncture is then covered with collodion and cotton and gentle pressure made on the sac. In a few days, if all symptoms of irritation have subsided, the injection may be repeated. The statistics which have been collected on several occasions show that more favorable results have attended the injection of Morton's fluid than any other method of treatment; but in comparing these statistics with those of excision it must be remembered that most of the latter date from the days when aseptic surgery was not understood as it is now and many cases died of sepsis in consequence; in addition to this the technique of the operation was comparatively imperfect. In consequence of greater familiarity with the operation and knowledge of how to avoid suppuration the recent statistics of excision show

great improvement, and there is no question that in many cases it is the operation to be preferred and in some the only possible operation.

The child is placed with the head lower than the tumor to avoid the too sudden escape of cerebro-spinal fluid. Incisions are made to include the thin skin covering the sac. If the latter have a small pedicle it may be ligated. If the sac have

they are so intimately adherent to the sac as to make this difficult, no effort should be made to save them, as numerous cases are reported where the nerves spread on the inner surface of the sac have been removed with the latter with no bad results. After closing the membranes efforts should be made to close the gap in the bones if possible. To effect this object various plans have been



Fig. 9.—Spina bifida and hydrocephalus. Fig. 10.—Club-foot, associated with hydrocephalus and spina bifida.

a wide base it should be opened and removed, enough of it being left to cover the opening without tension. Operators are divided as to whether or not efforts should be made to separate nerve-fibres if the latter are found spread over the inner surface of the sac or whether they should be removed with the latter. If they can be separated from the sac with ease they should be so separated and returned to the spinal canal. If, however,

tried. The periosteum from the side of the canal has been dissected up and brought across as a flap and stitched to a similar flap of periosteum raised from the opposite side of the spinal canal. Flaps of bone have been chiseled from the ilium or sacrum when the defect is low down or from the transverse processes when it is higher up, and these flaps turned over, like hinges, and sewed to others taken in a similar manner from

the opposite side, the periosteal surfaces being turned toward the cord.

In the dorsal region flaps have been taken from adjacent ribs and pushed through the erector-spinae muscles and sutured to flaps from the other side. Portions of the scapula of the rabbit have been employed to cover the gap in the bone and flaps of the periosteum of a rabbit's scapula have been sewed to the periosteum on the edges of the gap. Plates of celluloid have also been employed to stop the gap. In some cases the bone-gap is so extensive that no efforts to repair it are made, and in any case the operation is completed by joining skin flaps in the median line. If the tumor has had a very broad base and the skin has been very thin it may be necessary to slide the skin from both sides of the trunk in order to make the flaps meet.

The fundamental principle to be carried out is practically the same as in an ordinary operation for hernia, and the effort should be made, as far as possible, to sew together the various tissues covering the spinal canal, each to its fellow in their own proper relation. The causes of mortality in the past have been shock and convulsions following the immediate removal of a large amount of cerebro-spinal fluid, the patient's head not having been kept lowered, and septic meningitis on account of faulty technique.

In the treatment of spina bifida stress is laid on the following points: 1. The position of the patient should be lying on the side with the head low. 2. The first incision should in all cases be a lateral one. 3. It is a distinct advantage to retain the fluid in the sac, or replace it by irrigation during the separation of the cord, etc., from the skin. 4. The insertion of the sponge to prevent leakage from the canal during operation. 5. The liberating lateral incisions to enable the aponeurotic coverings to be glided into

a position of complete approximation over the canal, and to be retained there by sutures without the tension which would otherwise exist. 6. The operation is applicable to cases of meningocele. 7. The use of a small drainage-tube for a few days between the dura mater and aponeurotic covering is advisable in case leakage of cerebro-spinal fluid occurs. Pearson (*Brit. Med. Jour.*, Nov. 5, '98).

A new suggestion for operating in this condition. Fine silver wire used to close the aperture in the vertebral column. After placing the nerve-structures and remnants of the sac within the canal, a No. 27 silver wire was, in a case reported, passed in continuous fashion from one side of the opening to the other through the periosteum, ligaments, and even through bone, the stitches being sufficiently close together to form a firm covering incapable of displacement. The overlying soft parts were sutured with silk-worm gut. The result to date of writing was excellent. L. Freeman (*Jour. Amer. Med. Assoc.*, March 22, 1902).

In hydrocephalus it has been proposed to drain off the cerebro-spinal fluid by tapping through the spinal column instead of by way of the orbit or anterior fontanelle. If this method is adopted the needle of the aspirator should be introduced in the median line between the sacrum and the last lumbar vertebra by preference, as the opening between the bones is larger here than higher up. The needle may, however, be introduced between the fourth and fifth or third and fourth lumbar vertebræ. It should not be inserted higher.

This same treatment has been tried in cases that seemed to be tubercular meningitis, with the result that the patient survived.

Parkin proposes to trephine the occipital bone and so gain access to the subarachnoid space and by aspiration relieve the intracranial pressure in these cases. The prognosis without operation

is so universally fatal that the occasional successes that have followed these procedures render them worthy of trial.

Wounds and Injuries of the Spine.

Gunshot and Punctured Wounds.—

Bullet wounds of the spine are not necessarily fatal, and whether or not the bullet should be removed will depend largely upon its location. The x-ray here serves a most useful purpose in locating the bullet, pictures being taken in two diameters of the body, or preferably, with copper points superimposed on the trunk, so that the actual distance of the bullet from the surface of the body may be accurately determined.

If the bullet is in an accessible position, it should be removed. It may, however, lie in such relation to the intrathoracic viscera as to make such a proceeding most hazardous, and, unless the wound of entrance has become infected by clothing or injudicious probing, it is well, in such cases, not to interfere. In any surgical interference, the strictest cleanliness must, of course, be observed, and Girdner's telephonic probe may be employed to advantage in exploring for the bullet.

The concussion of modern high velocity projectiles causes, at times, a temporary paralysis, even when the wound is insignificant. But this soon passes away when the cord has been uninjured.

If the cord is compressed by fragments of bone, or blood, or the bullet, it should be freed from pressure by operation. If the bullet has passed through the body, but injured the cord in transit, it is proper to operate if the symptoms do not improve in a few days, as they may be due to pressure that could be relieved by operation.

Stab wounds of the spine are not of importance unless the blade of the weapon happens to pass between two

vertebræ, when it may divide the spinal cord, or, by injuring one of the vessels, cause hæmorrhage, which may either be fatal in itself or cause such secondary compression of the cord as to induce paralysis. In the latter case it is possible for the hæmorrhage to cease spontaneously, and, later, for the effused blood to be absorbed, and paralysis gradually diminish.

If a portion of the blade has been broken off and left imbedded in the tissues, it should be searched for and removed, provided it is giving rise to irritation, and can be removed with safety.

Sprain and Dislocation.

The vertebral column may be sprained as any other joint of the organism. If at all severe, it may be accompanied by a tearing off of small bundles of muscle.

In addition to the damage that may be done to the soft parts and bones, there is to be considered the injury that may at the same time be inflicted upon the spinal contents: a much more serious matter. There may be laceration of the vessels, producing hæmorrhage, which may compress the cord sufficiently to cause paraplegia, or hæmorrhages into the substance of the cord itself, or there may be laceration of the cord. There may be also so-called concussion.

Symptoms.—These will depend upon the amount of damage that has been inflicted. There may be an external hæmatoma, which may not show itself for several days. If there has been a spinal hæmorrhage it may either be in connection with the membranes either extradural or subdural (hæmatorrhachis) or in the substance of the cord itself (hæmatomyelia).

If the hæmorrhage is extradural it is less apt to compress the cord sufficiently to cause paraplegia. The hæmorrhage in either variety may be extensive enough

to pass from one end of the cord to the other.

If the paraplegia does not come on for some hours after the injury and if the line of anæsthesia mounts higher quite rapidly it is quite probable that hæmorrhage is the cause. Browning has suggested the use of an aspirator-needle to clear up the diagnosis.

If the hæmorrhage is in the cord itself, it may be either what is called a "destroying" or a "compressing" lesion. If the former, there will, of course, be permanent paralysis corresponding to the destruction of tissue. If a "compressing" lesion exists, there will be paralysis and anæsthesia, more or less complete, below the level of the injury, with retention of urine and fæces, and probably priapism, which subside as the blood is absorbed.

If a diagnosis of hæmatorrhachis can be made out and no improvement occurs after a sufficient length of time has been given for the blood-clot to be absorbed, it would be good surgery to open the spine for the purpose of removing the compressing clot. Iodide of potassium internally is supposed to be useful in effecting absorption of clot.

Under the head of sprains may be classed a number of injuries of the spine which are accompanied by various disorders of the nervous system. These symptoms so frequently follow railway injuries that the term "railway spine" has been used in describing them, and some have concluded that the prompt recovery that at times follows the awarding of damages by a jury is proof that the patient was feigning disease; but the same symptoms in many instances are found when no one is held responsible for the injury and the question of damage does not come into consideration.

In some of the cases in which death

has followed the shock, an autopsy has failed to reveal any gross lesions of the brain or cord. In other cases hæmorrhage is the cause of many of the symptoms, and in others there is a traumatic neuritis.

Some of these cases are incapable of any muscular exertion (unless the back is supported, and even have little control of the bladder), but when suspended and fitted with a snug plaster-of-Paris corset can do a fair amount of work. Many of these cases require the use of supports for the spine for years, though they are eventually able to dispense with it.

Just as in case of sprains in any other part of the body, the mistake is often made of regarding slight cases as of trivial importance. If recovery does not promptly take place in mild cases, the spine should be protected by support until all pain has ceased, or the patient may be left with a weak back for the balance of his life. The plaster-of-Paris jacket is the most easily applied and effective apparatus in these cases. Anything which will immobilize the parts, and allow the trunk to move as a solid mass, will answer the purpose.

Dislocation of a vertebra is rare, but of moderately frequent occurrence, though usually it is accompanied by fracture, more or less extensive. It is most often met with in the cervical region; next, in the lumbar; and very seldom in the dorsal.

The diagnosis is to be based upon the sudden occurrence of disability following traumatism, with some departure from the ordinary shape of the spine. Efforts at clearing up the diagnosis must be very guarded, as it is quite possible by careless manipulation to injure the already compressed cord so severely that permanent paralysis will ensue. If an x-ray apparatus can be secured, its aid should be

invoked in making an exact diagnosis, which is perfectly easy in the cervical, and fairly so in the lumbar, regions, while sciagraphs of the thorax are unsatisfactory, except in children or very thin adults. It must also be noted that large experience in the interpretation of normal sciagraphs is necessary, to enable one to comprehend properly one of a pathological condition.

Treatment.—Efforts should be made by manipulation to replace the dislocated vertebræ, and experience alone can guide the surgeon as to just how these manipulations should be made. In case pressure upon the cord is urgent enough to demand it, the vertebræ should be exposed, by incision, if necessary, to effect reduction, such points of bone as interfere with the latter proceeding being removed for this purpose by the rongeur. If operative interference becomes necessary, it should not be delayed, as, the longer the spinal cord is subject to compression, the less likelihood there will be of repairing such injuries as it may have sustained, and, if it has been absolutely destroyed by the traumatism, the fact will then become known, and the patient and his friends know definitely what result to expect. If the case is one where no damage has been done to the cord, if the patient be free from pain, and the deformity slight, it will be unwise to endeavor to replace the vertebræ, as not infrequently they become ankylosed in their new position, with comfort to the patient and safety to life, while efforts to restore them to their original situation may result disastrously.

Bed-sores.—After injuries of the spine among the most distressing results that follow damage of the cord are bed-sores. These differ from the ordinary bed-sores which are caused by pressure of bony prominences, such as the scapulæ, sacrum,

coccyx, trochanters, and heels, against the bed, and which are made worse by irritation of the skin by contact with urine and fæces in the bed, etc., and are caused by paralysis of the nerves. They sometimes form inside of twenty-four hours, and usually first make their appearance as erythematous patches, which then turn into blebs, which burn, leaving a raw sore, which sloughs very deeply, perhaps down to the bone. If one side only of the cord has been injured the bed-sores will form on the opposite side.

TREATMENT.—This consists in the removal of all pressure, keeping the skin absolutely clean, washing the surface with alcohol and alum several times a day, and, after being thoroughly dried, dusting it with lycopodium, talcum, or boric-acid powder.

Another constant accompaniment of cord-lesions is retention of urine from paralysis of the bladder. This is accompanied by incontinence of urine, and the patient lies in a pool of decomposing urine unless constant care is exercised to keep him dry.

On account of the paralysis of the bladder, part of the urine is retained, and becomes decomposed and soon sets up disturbances in the kidney. If great care is not exercised to keep all catheters scrupulously clean, this is sure to follow as the result of infecting the urine.

Sacro-iliac Disease.

The recognition of this disease is based chiefly upon the position of the patient, who bends to the opposite side in order to relieve the affected sacro-iliac joint, as far as possible, from the pressure of the body, the weight being borne almost entirely on the opposite leg. Difficulty in bending or twisting the body is frequently experienced, and pain extends down the thigh, in the course of the

great sciatic nerve. Careful local examinations will show tenderness on pressure, over the sacro-iliac joint, and if the two ilia are pressed together, so as to crowd them against the sacrum, pain will be produced. The same pain may be produced by crowding the head of the femur into the acetabulum, as pressure will thus be transferred to the hip-joint, but hip-joint disease can be excluded by the production of pain when the iliac crests are crowded together, and the hip-joint thus left out of consideration.

The temperature is apt to be but slightly elevated above normal: perhaps half a degree. The disease is likely to be mistaken for lumbago and sciatica, but the position as described above is typical in the writer's experience of this affection.

Treatment.—If the pain is extremely acute, the patient may be put to bed, with traction applied in the long axis of the thigh, and also at right angles to it, in order to relieve pressure on the sacro-iliac joint, as far as possible. If the pain does not rapidly subside, the actual cautery should be applied, burning very deeply along the line of the joint. Mere superficial scarification is ineffectual. The weight of the patient should be borne on the sound leg, and an elevation of from four to six inches, according to the size of the patient, should be applied to this shoe, in order that the foot of the affected side may swing clear of the ground. The shoe of the affected side may have half a pound of lead, or more, according to the comfort of the patient, fastened to the sole, to produce traction on this joint.

If suppuration takes place, it will be necessary to thoroughly remove all tubercular foci, being careful that no pockets remain inside of the pelvis to cause infection. The older writers assumed that

suppuration in sacro-iliac disease was necessarily fatal, but modern results show that this is by no means so.

At times, it is extremely difficult to differentiate between sacro-iliac and sacro-lumbar tuberculosis. In the latter, the plaster-of-Paris jacket gives prompt relief, and it is possible that it may be of use in sacro-iliac disease, although the writer has never personally made use of it.

Disorders of the Coccyx.—The coccyx rarely suffers from disease, except as the result of a traumatism, when it may undergo necrosis, and require removal.

COCCYGODYNIA, so called, at times demands the removal of the coccyx, which is performed by enucleating it through a longitudinal incision, made directly over it. But the great majority of cases that suffer from pain in the coccyx do so because of some other disturbance,—either a misplaced uterus or exhausted nervous system,—and such cases must be very carefully excluded before the diagnosis of coccygodynia is made, otherwise, although the bone be removed, the pain will continue.

Laminectomy.—Access to the spinal canal for the purpose of relieving pressure on the cord caused by fracture, abscess, inflammatory exudates, or tumors or for any other purpose is almost always obtained by removal of the laminae of the vertebræ. The entire back should be prepared for operation with great care. If possible, the operating-table should be provided with a hot-water plate or other means of keeping the patient warm to lessen the shock, which is often severe, and means should be at hand for subcutaneous injection of salt solution in addition to the ordinary stimulants. A large number of hæmodynamic forceps will be required, as very

many bleeding-points must be seized at once.

In many cases the difficulty which has given rise to the necessity for operation has interfered more or less with the function of respiration, and, as the patient is of necessity placed in the prone or semi-prone position, the anæsthetist must pay more than usual attention to the condition of the patient.

Many surgeons advise making a single straight incision in the median line, which should be long enough to include five or six vertebræ. The muscles are then retracted to such an extent as to uncover the laminæ on one side. A short cutting knife should be used to free the muscles from the bone, for, if a dull instrument is used, the tissue is apt to be so badly lacerated that necrosis follows.

Hæmorrhage is apt to be very profuse at this stage of the operation, but time will be wasted if the surgeon attempts to catch vessels. He should, instead, proceed rapidly to complete the incision and stop the bleeding by pressure of compresses wrung out in water as hot as can be borne by the hand. The wound should be tightly packed while the laminæ on the other side of the spine are being exposed. The second wound is then packed and the bleeding checked in the first. Peroxide of hydrogen at this stage is of use as an hæmostatic. The interspinous ligament is cut through. In the dorsal region the incision must be made in a slanting direction, owing to the overlapping of the upper over the lower vertebræ. With a rongeur or some of the various kinds of rib-cutters the laminæ are then cut through and removed.

Instead of this plan a number of surgeons of experience prefer making an osteoplastic resection, using an H or U incision. Some of them use Hey's saw

or a chisel to divide the laminæ. Care must be had to make the cut through the laminæ at a sharp angle, otherwise it will not enter the spinal canal. The interspinous ligament of the vertebræ at the cross-cut is now divided, and the flap with the spinous processes and arches attached is now reflected upward and to one side, otherwise the spinous processes will strike each other and prevent lifting the flap.

When the arches have been removed, a layer of adipose tissue is met with; this should be divided in the median line and pushed aside, when the dura will be brought into view. Bleeding, which occurs during this process, can be controlled by pressure, hot water, and peroxide of hydrogen. The cord should pulsate. If it does not, the absence of pulsation may point to adhesions, swelling of the cord, or pressure by bone or fluid. If relief from bone-pressure is being sought, it often is not enough to remove the laminæ, as the pressure may be caused by encroachment on the anterior surface of the spinal canal. To reach this the spinal cord may be drawn to one side by an aneurism needle or other blunt hook, and this proceeding will be much facilitated if the two extremities of the patient's trunk are supported on sand-bags, making the spine concave posteriorly, so as to relax tension on the cord. Should it be necessary to divide any nerve-roots in order to move the cord far enough to one side to reach the bodies of the vertebræ, these nerves should be sutured before the close of the operation.

If the dura is distended with blood, its color will be purplish; yellow, if pus be present. The presence of a tumor can usually be determined by touch.

If the cause for which the spinal canal was opened has not been satisfactorily removed, the dura should now be opened.

If a tumor be present, it should be removed if possible, but it may infiltrate the cord so as to be inoperable. Blood-clots, fragments of bone, etc., should, of course, be removed when the cord is lacerated. Efforts to suture the cord have so far been unsuccessful. The dura should be closed with fine sutures unless for some reason pressure on the cord is not desired. The skin incision may or may not be drained, the dependent position of the cut favoring the escape of fluid. If a drainage-tube is employed, it should be removed in twenty-four hours. A plaster-of-Paris bandage outside all the dressings is advisable in almost all cases—certainly in those for Pott's disease and in fracture.

Seventeen laminectomy operations performed. Of 7 acute traumatic cases, 3 of which were in the cervical region, no shock followed operation, and even in 10 rapidly-fatal cases a temporary improvement followed intervention. Those injured in the upper part of the cord died, with sudden and marked elevation of temperature. Two dorsal cases lived for several months, neither injured nor benefited by the operation. Autopsy in three cases showed complete crush and softening of the cord. Of 4 chronic traumatic cases, 1, a fracture dislocation of the second cervical, was markedly improved in the paralysis of the upper extremity and in the motions of the head; a second, operated upon during a secondary acute affection of the cord, was not benefited by interference, but died in a few hours with high temperature. A third middorsal case, and almost hopeless from the start, was relieved of the athetosis, but gradually succumbed to sepsis. A fourth, upper lumbar, though paraplegic and typhoidal at time of operation, made a complete recovery, so that she could earn her living at general housework at the end of eight months. Of 2 adults with paralysis from caries, 1, upper cervical, was perhaps slightly benefited; the other, one of 10 earlier cases, died of acute peritonitis, probably

from being placed in the prone position after operation,—a position that has proved not only useless, but at times dangerous. Of 2 cases of syringomyelia, both were markedly benefited by operation, and though ultimately the disease is fatal, yet the relief justifies the simple operation of opening the spine and dura. Two cases of sarcoma were operated upon,—one a diffuse growth, the other melanotic; but very little, if any, benefit resulted. In operating, a single median incision is recommended; hæmostasis by gauze packing; removal of the laminæ by special forceps, without chisel or trephine; the dorsal position after an operation that should not last over half an hour. J. C. Warren (Boston Med. and Surg. Jour., May 18, '99).

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SPLEEN, DISEASES OF.—The spleen shows little tendency to primary disease, but is easily affected secondarily in infectious states of the blood and in diseases of the blood-forming organs.

Excluding enlargements of the spleen due to malaria, syphilis, leukaemia, rachitis, etc., the primary enlargements of the spleen are divided into two classes: 1. Those that give rise to no symptoms except of a mechanical nature. These are more common than is generally supposed. 2. Those that are associated with anæmia, for which the term splenic anæmia is to be preferred. The special features of these are their chronic course: the bronzed skin, the chlorotic type of blood, and the hæmorrhages. William Osler (Phila. Med. Jour., Dec. 17, '98).

The splenic substance consists essentially of an aggregation of lymphoid tissue with a very rich vascular supply. Its function is uncertain, but that it is not essential to life or development is shown by the effects of its removal in lower animals as well as in man. If it has become materially altered by chronic disease its removal is not followed by

any definite disturbances other than those incident to the operation, as compensation has often previously been established.

After the removal of a healthy spleen, however, there are marked constitutional disturbances. The following symptoms have been noted: Extreme anæmia, emaciation, daily rise of temperature and increased frequency of pulse, attacks of fainting, headache, drowsiness, great thirst, severe griping pains in the abdomen and pains in the arms and legs; marked enlargement of the lymphatic glands, which may be permanent and compensate for the loss of the spleen; great diminution of the red blood-corpuscles, and considerable increase of the leucocytes.

The spleen personally extirpated in some 200 guinea-pigs, and subsequently virulent diphtheria bacilli or the toxins obtained from them have been injected. With the toxins there was no distinct difference between the animals with or without their spleens. In the case of the bacilli, animals deprived of their spleen lived longer than the others. With the injection of virulent anthrax the animals died in about the same time, whether the spleen had been previously extirpated or not; only one animal, and that without its spleen, survived. Different results were obtained with a virulent pyocyaneus toxin and an active cholera culture. In the case of the bacteria the animals without their spleen lived much longer than the others. Thus, both with diphtheria, cholera, and pyocyaneus bacilli the animals deprived of their spleen showed increased resistance, and especially with the two last-named bacilli.

A considerable leucocytosis followed upon the splenectomy. Thus it is concluded that the splenectomy produced the hyperleucocytosis, and this latter led to an increased bactericidal action of the blood and to an increased resistance against infection. Blumreich and Jacoby (*Berl. klin. Woch.*, May 24, '97).

After splenectomy the red blood-cells and hæmoglobin are greatly diminished, and the leucocytes increased, and shortly after operation (ten to twenty-three days) the red blood-cells and leucocytes are again normal in ratio. There is, however, a deficiency in the amount of hæmoglobin which persists, in slight degree, for some months. Frank Hartley (*Med. News*, Apr. 2, '98).

The symptoms gradually abate; convalescence is slow, but recovery becomes complete. In children these symptoms are much less marked and may be absent, probably on account of the great abundance of lymphatic tissue and of red bone-marrow in early life. In some cases the existence of accessory spleens doubtless accounts for the absence of symptoms after removal.

Hyperæmia of the Spleen.—Acute hyperæmia of the spleen occurs fairly constantly in acute infectious diseases, such as typhoid fever, septicæmia, and ulcerative endocarditis. It is also met with, but less frequently and in less marked degree, in toxæmia. In all infectious diseases there is great tendency to the accumulation of bacteria in the spleen. The free blood-supply sweeps them into the spleen and on account of the slower current through its dilated vessels they are left behind in its substance where they may be found, in many instances, weeks after they have disappeared from other organs.

The presence of bacteria in the spleen causes hyperæmia and swelling of the organ, especially marked in early life, when the lymphoid tissue is most abundant and the capsule most distensible. The swollen spleen is usually soft, may be even diffuent; but it may be firm, especially in more chronic cases, or in repeated attacks. The substance is usually dark, but it may present a grayish color from the great number of leuco-

cytes present. The Malpighian bodies are generally affected, being swollen on account of great proliferation of their cellular elements, which may show necrotic changes caused by the toxins.

The pulp also shows much proliferation of its cellular constituents, and may present areas of necrosis, and many small hæmorrhages. Similar changes may be caused by toxæmia without the presence of bacteria in the spleen, but they are less marked, as the poison is much less concentrated than it is when produced in the spleen by active bacteria present.

Malformations.—The shape of the spleen may deviate greatly from the normal. It may be rounded or elongated. Its anterior margin may present several notches, or a single deep one almost dividing the spleen into two parts. The notch may be near the lower end or even on the posterior border. Long processes may be given off from the main body; such a process has been met with extending down into the serotina, doubtless carried there in the descent of the testicle. Accessory spleens—splenculi or lienculi—are quite often met with, usually in peritoneal folds near the hilum. Occasionally the spleen is represented by a number of small masses scattered about the peritoneum or clustered into masses like bunches of grapes. They may become imbedded in the spleen itself. They are supposed to be more common in early life. Congenital absence of the spleen is very rare in otherwise normal bodies.

Atrophy.—In children the spleen is large; after middle life it undergoes atrophy, as is the case with other lymphatic structures, such as the tonsils, Peyer's patches, thymus gland, etc. In old age atrophy may be of extreme degree, only a remnant being left. The capsule is shriveled and thrown into

folds; it is somewhat opaque and thickened. From atrophy of the pulp the vessels and trabeculæ stand out prominently. In some cases there is great increase of the interstitial connective tissue as in cirrhosis of the liver or kidney, and the organ may not be reduced in bulk.

Hypertrophy.—**SYMPTOMS.**—There is usually marked anæmia and often internal hæmorrhages, especially intestinal; but these symptoms are probably due to the associated conditions rather than to the spleen itself, and to these the treatment should be directed.

Cases of so-called primary enlargement of the spleen are divided into: (1) those in which the spleen is enlarged without causing any symptoms other than those due to mechanical pressure: (2) cases of enlargement accompanying anæmia. The former condition is more common than is ordinarily suspected. Usually in this class the spleen is only moderately large. In the past few years there have been personally seen 4 patients, all women, apparently in perfect health, complaining only of a feeling of pressure in the abdomen, in all of whom the spleen was much enlarged. The term anæmia splenica, which describes the second class, should be restricted to those cases in which progressive anæmia develops in connection with primitive splenomegaly. The relation of the enlarged spleen to the anæmia is still in doubt. Four cases of this class have come to personal notice during the present year. The peculiarities manifested in these cases were the remarkably chronic course, extending from 3 to 12 years, the chlorotic features of the blood, the hæmoglobin value often not more than 50 per cent.; the peculiar bronzing of the skin; and, lastly, hæmorrhages, which may be toxic, as in leukæmia, and widespread or mechanical, resulting directly from the condition of the enlarged spleen. Particular attention is called to the condition of bleeding, in which for many years hæmorrhages occur from the stomach and bowels; the bleedings are pro-

fuse, and in the above cases they occurred during a period of from nine to twelve years, while in the intervals the patients have regained their flesh and strength and have been able to carry on their occupations. The special feature of hæmorrhages in these cases are considered entirely due to mechanical causes. In no case have there been associated cutaneous or retinal hæmorrhages.

In diagnosing conditions associated with enlargement of the spleen it is necessary to recognize a primitive splenomegaly with a practically normal blood-count. Cases of chronic enlargement of the spleen extending over many years present, as a rule, anæmia of a chlorotic type, with low corpuscular and low leucocyte count. The more pronounced does the corpuscular anæmia become, the more striking are the changes in the red corpuscles, and in advanced cases the blood may be like that of a pernicious anæmia. The most confusing and puzzling condition, however, is that in which, with enlargement of the spleen, the condition of leukæmia may be present during one month, and in the following that of a simple splenic anæmia. The question of diagnosis from Banti's disease, primitive splenomegaly, with an associated terminal cirrhosis of the liver and jaundice, must be considered. Osler (Edinburgh Med. Jour., May, '99).

ETIOLOGY.—Great enlargement of the spleen is met with in chronic malaria, splenic anæmia, leukæmia, and occasionally in cases in which no apparent cause existed. In rickets it is also said to be enlarged; but probably this is rather apparent than real, and due to displacements of the spleen downward by deformity of the chest. The enlargement may be due to general and fairly equable increase of the various constituents of the organ, but in chronic cases the connective tissue is usually in excess. The increase in size may be so great as to extend to the pubes below and well across into the right side of the abdomen, and it may weigh fifteen or twenty pounds.

Analyses of 304 cases of rupture of the spleen collected from the reports of over 9000 post-mortem records in India. Of the 304 cases, 147 were males and 157 females. Nearly half the number were from 25 to 45 years old. The youngest child was a female of 18 months, killed by a kick. As to the cause of the injury, 102 cases resulted from blows with a club; 62 from blows with the fist, kicks, or slaps; 22 resulted from falls; while in 77 cases the person was run over. In 133 instances the rupture was on the inner surface, in 55 on the outer surface, and in 24 both surfaces were involved. In 225 cases the rupture was single, and in 79 multiple. In 107 instances the spleen was "much enlarged," in 125 "enlarged," in 8 there was no enlargement, while in 64 no information on this point was given. In 32 out of the 304 cases some other organ suffered rupture in addition to the spleen, of which the most common was the liver in 75 instances and then the left kidney 5 times. D. G. Crawford (Indian Med. Gazette, June, 1902).

That the enlargement is not due to congestion alone is proved by the fact that it is never materially enlarged in diseases of the liver, heart, or lungs, in all of which venous obstruction is a prominent symptom. Some toxin or irritant seems necessary to produce the changes present.

TREATMENT.—In malaria, quinine is indicated and in splenic anæmia arsenic is the only remedy that seems of service. In a typical case under my care a few years ago the use of arsenic succeeded satisfactorily, while general treatment with iron, etc., was of no benefit.

A comparison of the operations on the spleen may be thus stated:—

(a) Removal of the whole spleen necessitates the ligaturing of: 1. The splenic branches or, what is the same thing in effect, the splenic artery and nerves before they divide into their terminal branches. 2. The vasa brevia arising from the terminal or splenic

branches. 3. The branches from the left gastro-epiploic and phrenic when present.

(b) Removal of the upper half necessitates the ligaturing of the same arteries except the lower two or three terminal branches, as many as from twelve to eighteen vessels and nerves being included in the ligatures on the pedicle.

(c) Removal of the lower half can be effected by ligaturing the lower two or three terminal branches only. In the two latter operations there is, in addition, the continuous ligature across the spleen.

From this it will be seen that excision of either the whole or the upper half of the spleen involves great damage to the splenic plexus with its intimate (three-fold) connection with the solar plexus and right vagus; entails direct interference with part of the nerve-supply of the stomach and omentum, and severe indirect interference with the vagi and all the sympathetic nerve-supply of the abdomen; the diaphragmatic plexus is often involved and considerable tension has to be applied to the pedicle, and therefore on the celiac and solar plexus and the vagi, thus augmenting the interference with these nerves. The excision of the lower half entails but slight damage to the splenic plexus, and therefore but slight indirect interference with the solar plexus and vagi; the nerve-supply to the stomach, the omentum, and the diaphragmatic plexus is never involved and but slight tension has to be applied to the pedicle. As shock is due to severe inhibition and exhaustion of nerve-function, and, the grosser the lesion, the greater is the shock that results, this great difference in the amount of interference with the nervous system in these operations is the explanation of the great difference in the amount of shock following them; and in the excision of the whole spleen or of the upper half the resultant shock is due to inhibition and exhaustion of the vasoconstrictor fibres of the abdominal sympathetic, and is probably intensified by great interference with the proper performance of the functions of the heart, lungs, stomach, etc., reflexly by means of the vagi.

These considerations should induce one to advise in suitable cases in the human being—*e.g.*, abscess, tumor, or cystic disease confined to the lower half, or in hypertrophy which resists medicinal treatment—the excision of the lower half in preference to that of the whole spleen, as the same object would be attained (the removal of the disease or the enlargement), while a considerable portion of the spleen would be left to carry on its function; and, further, there would be, as a reasonable inference, a considerable reduction in the death-rate. H. M. Jordan (*Lancet*, Jan. 22, '98).

Left half of the abdomen sprayed with ether in twelve cases of enlarged spleen. From 6½ to 7½ drachms of ether were sprayed over the splenic area, once daily, through a Richardson atomizer. Marked reductions in volume of the spleens were observed in all twelve cases. No bad results. As a rule, the affected area only was played upon, the remainder of the abdomen was covered with cotton-wool. Moscucci (*Riforma med.*, Apr. 23, '98).

Splenectomy has been growing rapidly in favor, and, as the operative technic improves, the mortality percentage has greatly lessened. It has been shown by experiments on animals and by observations on persons that it is entirely possible to remove the spleen from an otherwise healthy man without having any serious symptoms develop. Three hundred and sixty cases of extirpation of the spleen quoted, 138 of which were followed by death. In another series of cases quoted, 97 operations before the year 1890 showed a mortality of 42.02 per cent., and 164 between 1891 and 1900 showed a mortality of only 18.9 per cent. Total extirpation of the spleen should never be done for leukæmic hypertrophy, as statistics show a mortality of 71.4 per cent. F. B. Hagen (*Archiv f. klin. Chir.*, B. 62, H. 1, 1901).

Infarcts.—Embolism of the splenic artery most frequently arises from particles of blood-clot or vegetations dislodged from the left side of the heart. If the emboli originate from ulcerative endocarditis they will contain pyogenic bacteria and suppurating infarcts will

result. Such emboli occur also in pyæmia, originating in suppurative foci in various parts of the body and give rise to multiple abscesses of the spleen.

Simple non-infective emboli usually arise from benign endocardial lesions or from blood-clot, and cause simple infarction. Thrombosis of a branch of the splenic artery in acute fevers and in leukæmia may occur and infarction result.

A simple splenic infarct is usually at first pale, but, after some hours or days, the veins of the ischæmic area become filled with blood, which easily passes through their walls, as they have been rendered more permeable by the long-continued anæmia.

The infarct forms an irregularly triangular mass with its base projecting slightly above the surface of the spleen. Decoloration soon takes place, and the infarct is gradually converted into a cicatrix.

If the embolus contains pyogenic micro-organisms the early stages do not differ from those of non-infectious emboli; later the infarct becomes converted into an abscess.

Abscess.—Occasionally a large single abscess is found in the spleen with signs and symptoms indistinguishable from subdiaphragmatic abscess, an abscess of some other abdominal organ, or of the abdominal wall itself.

Infective emboli from malignant endocarditis are among the most frequent causes of splenic abscess. "Hence a tender swollen spleen with pyrexia and a cardiac murmur is a certain sign of ulcerative endocarditis" (Fagge). In such cases softening and suppuration soon follow the occurrence of infarction. In general pyæmia embolic abscesses are similarly produced and often met with. The emboli may come from suppurating

foci in any part of the body. The abscesses are usually small and multiple.

Extension of inflammation from a neighboring organ usually only causes local perisplenitis, but perforating ulcer of the stomach or intestine that becomes adherent to the spleen may cause abscess in it.

Injury of the spleen may lead to supuration by lessening its resistance to pyogenic bacteria that gain access to it through the blood.

Abscesses are occasionally met with in typhoid fever, malaria, suppurative pylephlebitis, etc.

The treatment is the same as that of any other abscess in this situation.

Tuberculosis.—In general tuberculosis the spleen is always much affected. The tubercles are more evident on the capsule than in the substance, where they are with difficulty distinguished from the Malpighian bodies. The spleen is large and soft. In chronic tuberculosis large caseous masses are not common, but occur in children oftener than in adults. Miliary tubercles are usually found about the masses. Before caseation takes place the masses resemble lymphadenomatous deposits, and can only be differentiated by the microscope.

Lardaceous Disease.—Waxy deposit takes place probably more frequently in the spleen than in any other organ, and it may be alone affected. The deposit may exist in the Malpighian bodies or the substance of the spleen. In the former and more common form the capillary walls in the Malpighian bodies are affected. The Malpighian bodies are much enlarged and gray in color, resembling sago-grains; hence the name "*sago*" spleen. The organ is somewhat enlarged and anæmic.

In the latter and rarer form the arteries of the splenic substance are af-

fect, the Malpighian bodies usually escaping and later becoming atrophied. Lardaceous deposit takes place in the pulp later, and the spleen may become much enlarged and converted into a large, resistant, pale mass with rounded edges.

Tumors of the Spleen.—Primary carcinoma of the spleen is of doubtful occurrence, and even secondary infection is rare. The peritoneal coat and the connective tissue of the hilum may become involved by extension of disease from the stomach, peritoneum, or retroperitoneal glands. The growth may then invade the gland directly or extend along the vessels from the hilum. Primary sarcoma may occur, and a few cases have been described. Secondary growths are not very rare.

Cysts of any kind in the spleen are rare. Simple serous cysts are occasionally met with. Small ones on the surface may result from a dilated lymphatic vessel. Traumatism may be followed by a cyst containing blood or *débris* from previous hæmorrhage. Hydatid cysts occur occasionally in the spleen, which alone may be affected, or in association with other organs, especially the liver. In half the cases there are no symptoms. Innocent tumors of the spleen other than cysts scarcely ever occur.

Wandering Spleen.—Many errors in diagnosis have occurred from wandering spleen. The organ may be found in any part of the abdomen, and it is often extremely mobile, especially in women who have borne children. It may cause great discomfort, rolling about like a foreign body. If twisting of the pedicle occurs it may be followed by gangrene or atrophy of the organ. It may become adherent to any organ and drag it out of its place.

The diagnosis may be difficult, the mass being liable to be mistaken for tumors of the ovary, kidney, pancreas, etc. Its shape, the notch on its anterior border, and the evidence of its absence from its normal situation may make a diagnosis possible.

TREATMENT.—In some cases it can be retained in position by a well-fitting abdominal bandage. If this fails it can be exposed and sutured in place. When this fails and it is giving discomfort it should be removed.

Perisplenitis.—This may be local or general.

Local perisplenitis may result from many causes, among the most frequent being the extension of inflammation from diaphragmatic pleurisy and from the pleurisy occurring in pneumonia of the base of the left lung. It may also be secondary to inflammation of some other abdominal organ. In other cases it originates from some cause within the spleen, as infarcts, tubercle, and lymphadenoma.

General perisplenitis usually arises from chronic peritonitis which may affect the whole peritoneum. It resembles closely the condition in perihepatitis. The spleen is covered by a dense membrane of irregular thickness. Its outer surface is fairly smooth, but shows many pit-like circular depressions similar to those seen on the liver. They are probably due chiefly to disturbance of the exudate during the plastic stage by respiratory and other movements of the spleen and partly to ruptures caused by cicatricial contraction that took place during the organization of the exudate. Adhesions may be absent in these cases.

Capsulitis, perisplenitis, or thickening of the capsule, is one of the most frequent lesions of the spleen, but the condition probably is of little clinical importance. Enlargement of the spleen

may arise from a number of causes, which may be roughly classified under (1) infections; (2) inflammations; (3) infarction; (4) passive congestion; (5) lardaceous disease, and (6) tumors, cysts, etc. Among the very large spleens only a few causes are represented: malaria, typhoid fever, cirrhosis of the liver, and ulcerative endocarditis. Taylor (*Lancet*, May 28, 1904).

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SPRAINS.—A joint is said to be sprained when it is twisted violently so that its ligaments are either overstretched or partially torn, with or without displacement of the osseous surfaces. Sprains of the wrists and ankle-joints are most common.

Symptoms.—The first symptom of sprain is a very severe, often sickening pain, which is rapidly followed by swelling (most noticed in those parts where there is least pressure from ligaments and tendons) and inflammation of the joints and its investing tissues, which is often chronic and tedious. As the inflammatory symptoms subside, the joint becomes stiff, and, when moved, pain appears and persists for some time. In some cases rigidity and wasting of the limb follow the disappearance of the inflammatory symptoms. If the ankle or the knee is sprained, the patient cannot walk at all or at best only with a limping gait.

Diagnosis.—The diagnosis of sprain is usually easy. If in a hinge-joint a lateral ligament has been entirely torn across, the gap may usually be felt, and an increased mobility of the joint will be present. Touch will detect a laceration of a muscle or a fracture with or without separation of the fragments as through the malleolus or in the lower end of the radius. "Sprain-fracture"

(fracture of a portion of the articular surface), as pointed out by Callendar, may occur in the ankle, and may not be detected by touch, thus explaining many cases of ankylosis of the ankle following an apparently simple sprain.

Etiology.—Sprains are usually produced by a sudden wrench or twist of the joint, and occur in the ankle as the result of a misstep or fall upon the foot, and in the wrist as a result of a fall upon the hand. They occur more commonly in young and middle-aged adults, in joints that have previously suffered similar injury, in deformed limbs, and in subjects having underdeveloped muscles and relaxed ligaments, as in weak-ankled persons.

Pathology.—A sprain may be so slight that its effect quickly subsides, or it may be associated with dislocation or fracture or both. The line of displacement usually passes through that part in which there is normally the least motion; so that in the hinge-joints it is lateral. Through this unnatural movement the synovial membrane is unfolded upon one side and compressed on the other and is usually crushed and torn. The ligaments are at first slightly stretched, but, being quite inelastic, may give way, if sufficient force be exerted upon them, resulting in various degrees of injury, from the rupture of a few fibres to that of the entire ligament, to its detachment from the bone, a fracture or dislocation, or a rupture of distant muscles. The blood-vessels about the joint are lacerated, and more or less extensive hæmorrhage into the joint-cavity, into the interstices of the articular structures, and into the surrounding connective tissue occurs. When the hæmorrhage into the joint-cavity is large, it indicates severe injury and increases the gravity of the case; the fullness resulting from such

extravasation may appear within a very short time, but usually after a few hours, being then formed partly by the extravasation, but principally by effusion into the joint-cavity and the structures about the joint. After several days discoloration of the skin is noticed, which is caused by subcutaneous capillary extravasation. When the hæmorrhage into the joint-cavity has been large, blood-clots often persist for some time, and, by becoming organized and adherent to the synovial membrane, result in the formation of adhesions which limit the movements of the joint, if they do not, indeed, cause ankylosis.

Prognosis.—The prognosis varies with the joint involved, the extent of the injury, the habit of the patient, the promptness of attention, and the efficiency of the treatment. When hæmorrhage into the joint-cavity has been large, there is more interference with the action of the joint. In persons of gouty or rheumatic habit the inflammation of the joint is generally tedious and chronic in character, and will only yield to suitable constitutional treatment (colchicum, iodides, etc.). In strumous subjects destructive disease of the joint often follows this injury.

Treatment.—Slight sprains need little attention; a stimulating liniment well rubbed in and the application of a bandage to give support are all that need be done. In sprains at all severe more active treatment is necessary, the nature of which will depend upon the condition of the joint when first seen. Two indications must be met: perfect rest must be assured and inflammatory action prevented or subdued. If the case is seen immediately after the accident, and before any great swelling is present, the joint may be strapped very firmly with long strips of plaster, over which an im-

movable dressing (starch, silicate-of-soda, or plaster-of-Paris bandage) may be applied, by which rest, immobility, and compression of the joint are secured. The application of an immovable dressing will allow the patient to go about and attend to business, crutches being used if the knee or ankle is involved, or the arm being placed in a sling if the joints of the upper extremity are affected. If preferred, the joints may be wrapped with cotton, and a plaster-of-Paris bandage applied over it. In either case, if much blood has been effused into the joint, it should be removed by aspiration, the needle being first made aseptic.

Should inflammation with much swelling be present, this may be subdued by the usual means (cold water, evaporating lotions, leeches, etc.); when the swelling has somewhat subsided, the care of the joint should follow the course already outlined to secure the necessary rest: immobilization and the compression of the joint. Later, when pain and stiffness alone are left, douches of cold water used twice daily, followed by massage with soap liniment, will usually restore strength and mobility to the joint.

For several years massage has been personally employed on sprains.

The old practice of immobilization of sprains is now generally conceded to be improper, for more than a few days. Personal routine practice, even in those cases in which there is considerable laceration, is to first use the hot and cold alternating douche for ten minutes to allay pain, then to gently rub and knead about the injured joint for some fifteen minutes, and to apply a flannel bandage. Perfect rest for twenty-four hours is enjoined. On the second day more thorough kneading and stroking is done and a little passive motion is employed; and this is followed up daily.

In the case of a "sprained ankle" in which there is much extravasation of

blood, tendo-synovitis, and escape of synovial fluid, the immobilizing treatment is most objectionable. By its use adhesions are apt to form, impairment of function with pain results, and where there is a tubercular taint proper conditions for a localized tuberculosis are established. The same is true of the wrist, knee, shoulder, and other joints.

The use of a skillfully-applied flannel bandage is a very important adjunct to properly-applied massage. The bandage should be broad, cut on the bias, and should cover with firm and evenly distributed elastic pressure all the parts as far as the adjacent joints on either side, with an extra pad over the injured joint itself.

After the first day the patient should go about on crutches, in the case of a sprained ankle; and, after the third day, he should be encouraged to begin bearing a little weight on the foot. Two to three weeks often suffice to put such a sprained joint in a condition for careful use. J. G. Mumford (Boston Med. and Surg. Jour., June 17, '97).

A plan of treatment that seems to be well suited to sprains of all degrees of severity, and which can be used with or without fixed dressings and bandages, according to the indications, is massage properly applied. Massage should not be begun immediately over a recently-injured joint; neither should passive nor active motion be encouraged in spite of pain caused thereby.

A snug bandage is usually sufficient to afford rest and support, and to press the swelling out in the intervals between the massages. But if the bandage does not give sufficient support, then an easily removable splint or plaster may be applied. Joints tender and swollen, that do not admit of massage being applied directly upon them, can be approached by commencing on the healthy tissues some distance above them and nearer to the trunk, by gentle stroking in the direction of the returning currents of lymph and blood, and gradually proceeding downward. The healthy tissues beyond the seat of the injury should also be similarly treated.

The returning currents are then pushed along more rapidly, making room for exudations to be carried off. For this purpose each hand should make alternate strokes, using the greatest possible extent of the palmar surface while the limb is in a comfortable position.

After working a few minutes in this manner, deep manipulation, or massage properly so called, may be brought into play, beginning, as before, above the painful joint by adapting the greatest possible extent of hand and fingers, one hand contracting and making the greatest push upward as the other relaxes while gradually approaching the objective point. The parts beyond the sprain should be treated likewise. By alternately stroking and kneading in this manner one can soon make gentle, firm pressure over the but recently painful and swollen joint. If sufficient tact be used this pressure may not hurt, and very soon it can have motion added to it. When a light touch is disagreeable, firm pressure often affords relief, so that the whole hand is better than the finger-tips.

In recent sprains and synovitis this method is rational. The good effects of the massage are continued by means of a bandage well applied. Rubber bandages are not advised except for temporary use, as when a patient with weak joints wants to go sea-bathing. A Domet (or cotton flannel) bandage may be used instead. Douglas Graham (Boston Med. and Surg. Jour., June 24, '97).

The Gibney treatment of sprained ankle is as follows: Ordinary adhesive plaster is cut into strips $\frac{1}{2}$ inch wide and in two lengths, about 12 and 18 inches long. As soon as the patient is seen, one of the longer strips is placed around the ankle, parallel to the sole of the foot, beginning in front of the big toe, carrying the strip around the ankle just above the contour of the sole, and bringing the end back across the top of the foot to about the point where the strip began. It is well to place, overlapping this initial strip, a parallel piece. These strips should be drawn as tightly as possible. Next another strip should be placed at right angles to them, which makes it run parallel to the back of the

leg. One of the shorter strips should be selected for this purpose. Beginning well behind and above the ankle, this strip should be carried down around the sole of the foot and brought up on the other side of the leg, making, as it were, a stirrup for the foot. This strip is closely applied. Now the strips should be applied alternately, first one around the ankle parallel to the sole, then one parallel to the back of the leg, each one overlapping the one previously applied, running in the same direction, to some extent, until the entire foot is inclosed in a boot of adhesive plaster, having the appearance of a shoe in which part of the heel has been cut away. Over this dressing is now placed an ordinary roller bandage. The patient should be careful for a day or two, when he can begin to move around rather freely. This dressing should be kept on until the pain and swelling have subsided. If the dressing becomes loose, it can be reinforced by additional strips placed over the loose ones. J. H. Adams (*Railway-surg.*, Jan. 10, '99).

Attention is called to the use of static electricity in the treatment of sprains. Personal technique is as follows: A thick woolen shawl, folded many times, is carefully placed over the ankle and foot, and the static massage roller is used as strongly as the patient can bear it for fifteen minutes on the foot, ankle, and leg. The patient is seated on a stool on the floor, not on the insulated platform. The roller is attached by the chain to the positive pole of the static machine. These patients will recover, when electrical massage is thoroughly used, in half the time required by other forms of treatment. C. O. Files (*N. Y. Med. Jour.*; *Pacific Med. Jour.*, Aug., '99).

A study of muscular and joint sprains has suggested the following conclusions:

Ligaments are rarely, if ever, torn in so-called sprains, and are never stretched. The pathology in the majority of sprains is a rupture of the areolar and connective tissue around the joint, and a contusion of the lining of the joints. Immobilization of muscles is not rest. On the contrary, in all sprains the muscles should have passive

exercise the first few hours and days, and active exercise after that. In the majority of cases, active exercise should be instituted from the beginning. The plaster casts should not be used at all, even in cases where there is a fracture, unless it be impossible to maintain a proper position of the joint. Hydrotherapy in the shape of ice applied over a wet cloth the first few hours; water in the shape of hot fomentations or in the shape of the Scottish douche, where stimulation is desired, is of very great value. The counter-irritation of static electricity in conjunction with massage is the best treatment for a sprain. The ambulatory treatment of sprains in conjunction with massage is to-day the best treatment. Haldor Sneve (*Jour. Amer. Med. Assoc.*, June 1, 1901).

Pain is the obstacle of the mobilization of the joint in case of sprain. Faradization for five to ten minutes a day completely banished the pain in a number of cases of both recent and chronic sprains. As soon as the pain was arrested the patient could mobilize the joint without trouble, and thus prevent or cure the functional impotence of the injured limb. Planet and Charrier (*Bull. de la Soc. d'Electrothérapie*, Nov., 1901).

The pathological conditions which respond most readily to the strapping seem to possess one factor in common: relaxation of tissue. This relaxation may follow acute or subacute inflammatory disturbances of a rheumatic, specific, gonorrhœal, tuberculous, or traumatic character. The good results obtained in strapping when such relaxation is present are due to the support thus afforded. It can be applied in cases of sprain so as to act as a perfect substitute for the injured ligaments, relieving them from all superincumbent weight, which adequately accounts for the ease with which patients walk about. A diagnosis must be made with great care and the exact nature of the lesions ascertained. Cook (*Medical Record*, Jan. 10, 1903).

Success met with in ten instances in reducing luxation at the shoulder by the following method: The patient being

laid on his back on the ground, the surgeon, placing himself on the injured side, grasps the luxated limb at the hand and begins to extend it slowly and gently. As the energy of the extension is slightly increased the limb is gradually abducted until it is almost vertical,—that is to say, parallel to the axis of the body. The arm is then slowly lowered while pressure is exerted by an assistant on the head of the humerus, which, with the arm fully raised, should be over the glenoid cavity. It is necessary, the author states, while extending and abducting the limb, to avoid excessive irregular extension, and thus to avoid setting up muscular spasm. The time taken in reducing luxation of the shoulder by this method varied in the author's cases from seven to thirteen minutes. Most of the patients on whom he has successfully applied this method were very strong workingmen. Roloff (*Centralb. f. Chir.*, No. 16, 1902).

STATUS LYMPHATICUS AND DISORDERS OF THE LYMPHATIC SYSTEM.

General Considerations.—In addition to the closed channels which carry the blood in a continuous round through the arteries, capillaries, and veins, there is another complementary system of vessels, found in every tissue and organ of the body supplied with blood-vessels, whose currents flow in one direction only, from the periphery to the centre, and discharge into the great veins near the heart the fluids which have been absorbed in the solid tissues of the body (for plate, see *ADENITIS*, volume i). The fluid contained in these vessels is nearly or quite colorless, especially in thin layers, and from its appearance is called lymph; the vessels with the lymphatic glands constitute what is known as the lymphatic system. In their anatomical structure the vessels resemble the veins; injury and disease affect them in a similar manner.

These vessels functionate as absorbents, and are the principal carriers of septic infection from the periphery to the central circulation. The serous flow from wounds, which necessitates the employment of drainage, comes from severed lymphatic vessels. The lymphatics are involved in all wounds. The numerous superficial lymphatic plexuses of the skin readily absorb antiseptic or poisonous solutions applied to the surfaces, and explains remedial action or poisoning, as the case may be. The amount of lymph in circulation is greater in youth than in advanced life, and the lymphatic glands are more highly developed and active; hence the greater frequency of disorders of the lymphatic glands in early youth. The lymphatic glands are scattered along the course of the lymphatic vessels and form part of the lymphatic system.

Status Lymphaticus (Lymphatism; Constitutio Lymphatica).—This is a somewhat rare condition observed chiefly in children and young persons, in which the lymphatic glands and lymph-tissues throughout the body (the spleen, the thymus gland, and the lymphoid bone-marrow) are in a condition of hyperplasia. This general lymphatic hyperplasia has been found associated with rachitis and with hypoplasia of the heart and aorta. These pathological conditions, having been found frequently in cases of sudden death, give them special interest. Paltauf and others of the Vienna school have studied this condition closely, and believe that persons who suffer from this hyperplasia have lowered powers of resistance and are particularly liable to cardiac paralysis. In England and this country this condition has received little consideration.

SYMPTOMS AND DIAGNOSIS.—The diagnosis of this condition is not always easy (Osler). Enlargement of the superficial

glands, enlarged tonsils, more or less swelling of the thyroid, dullness over the sternum, and enlargement of the mesenteric glands are the most prominent features. The signs of hypoplasia of the vascular system are more obscure, though Quincke believes that in these cases the left ventricle is dilated and the peripheral arteries may be much smaller. The subjects of the condition are generally infantile in conformation and poorly developed.

The attention of writers has been principally directed to this condition on account of the frequency with which it has been found in cases of unexpected death from trifling and inadequate causes. Instances of such are cited by Osler. The death of the son of Langhans, of Berlin, immediately after the preventive inoculation with diphtheria antitoxin; death in another child under similar circumstances; a number of cases of sudden death under anæsthetics, one under Osler's personal observation during anæsthesia for removal of adenoid growths; cases of sudden death of persons who have fallen into the water, and though immediately recovered, were dead, or who have died suddenly while bathing, and referred by Paltauf to this condition; the large group of cases of sudden death in children without recognizable cause, in whom the thymus has been found enlarged (the so-called "thymus tod"). Osler also suggests that certain of the sudden deaths during convalescence from the infectious fevers are referable to this condition. Escherich is inclined to the opinion that certain measures usually harmless, such as hydrotherapy, may have an untoward effect on children who are subjects of lymphatism, and adds that tetany and laryngismus may be associated with it.

Children with the *status lymphaticus*, in spite of their splendid appearance,

often sink rapidly under light attacks of the disease. The prognosis in such cases ought, therefore, to be guarded, the more so as such children are often looked upon by their parents as being particularly healthy. Galatti (Wiener med. Blätter, Dec. 10, '96).

PATHOLOGY.—Osler observes that the pharyngeal, thoracic, and abdominal lymph-glands are most frequently affected; the cervical, axillary, and inguinal less so, although they may show slight enlargement. There is usually much enlargement of the lymphatic structures of the alimentary tract, the tonsils, the adenoids of the pharyngeal vault, and the solitary and agminated follicles of the small and large intestines. The hyperplasia of the intestinal lymphatic structures, he notes, may be the most remarkable, "the individual glands standing out like peas."

The enlargement of the spleen is usually moderate. The Malpighian bodies may be very prominent, and, when anæmic, may resemble "large tubercles." The spleen is usually soft and hyperæmic.

The thymus is enlarged, swelled, and soft, and on section may exude a milky-white fluid. It may measure as much as ten centimetres (3.9 inches) in length.

The bone-marrow is in a condition of hyperplasia, and the yellow marrow of the long bones in young adults, and even in persons between the ages of twenty and thirty, has been found replaced by red marrow. Hypoplasia of the heart and aorta, hypertrophy of the thyroid gland, and, in a large number of cases in children, rachitis are associated with this condition.

Study of 9 cases of sudden death occurring in infancy and childhood, and of the literature. The writer concludes that (1) the condition known as the *status lymphaticus* is a definite pathological entity; (2) it is probably as-

sociated with, if not due to, a condition of intermittent lympho-toxæmia; (3) it may be associated with sudden death, probably as a result of lympho-toxæmia alone in some cases, or as a result of the action of toxic, physical, or psychic injuries which are rendered much more powerful than usual by the predisposing action of the lympho-toxæmia; (4) in some cases the sudden death is undoubtedly mechanical, and due to asphyxia from pressure of the enlarged thymus on the trachea. The mode of death may be presumably of cardiac, respiratory, or cerebral origin, while in association with anæsthesia special liability is furnished by goitre, either simple or exophthalmic, or by adenoid vegetations. The condition may have a distinct influence on infections, either modifying their course or even masking them; there is, however, no evidence that bacterial infection is to be held responsible for the lesions in most cases of status lymphaticus. G. Blumer (Johns Hopkins Hosp. Bulletin, vol. xiv, p. 270, 1904).

TREATMENT.—Clinical data are not sufficient to outline any specific treatment. Further observation and study of this peculiar condition may shed more light upon the clinical features, make clear the method of sudden death in these cases, and, perhaps, point out a satisfactory method of treatment.

Lymphangitis.—Lymphangitis (orrho-selenitis; angioleucitis) is an inflammation of the lymphatic vessels. Two varieties are usually noted. When the superficial lymphatic radicles are involved, the term “reticular lymphangitis” is applied; when the larger continuous lymphatic trunks are affected it is called “tubular lymphangitis” (Bellamy).

Reticular lymphangitis may be observed in its typical form in erysipelas, in which the streptococcus of erysipelas produces inflammation by invading the lymphatic radicles (see ERYSIPELAS). It

is also seen in many cases of circumscribed dermatitis attended with more or less œdema. It is present also in the “erysipeloid” of Rosenbach, where certain patches of superficial inflammation of the skin slowly spread from a point of primary infection (usually on the fingers), the point originally infected returning to its normal condition, while the inflammation extends peripherally, until after one to three weeks the disease has exhausted itself and entirely disappears, having traveled over the hands to the wrists. Rosenbach found in these cases a specific thread-forming, spore-bearing micro-organism derived from decomposing animal matter. In certain poisoned wounds attended by a rapidly extending inflammation, the lymphatic trunks become involved and both varieties of lymphangitis may be present. In injuries of the hands or feet that are neglected or are subject to motion and irritation, or where scratches and abrasions are brought into contact with decomposing matter a lymphangitis of a less virulent type may develop which may at first be confined to a small area of contiguous lymphatic radicles, but may, later, extend to the larger trunks (tubular lymphangitis) leading away from the original focus and appear through the skin as red streaks or lines running in the direction of the lymph-current, these red lines being tender to the touch. These streaks result from the blocking up of the lumen of the lymphatic vessels by a coagulated exudate, infiltrating, additionally, the circumjacent connective tissue, which is also inflamed.

As the infectious matter travels along the lymph-channels, it is carried to the glands into which the lymphatics empty, and inflammation of the lymphatic glands follows, sometimes without inflammation of the afferent duct. A sec-

ond group of glands may also become affected without any reaction in the ducts leading from the first to the second group. It is seen, therefore, that any serious inflammation of the ducts leading from the focus of infection to the glands is not necessary for the production of trouble in the latter.

If the infectious matter consists in part of pyogenic organisms of sufficient number and activity, suppuration will result along the course of the inflamed vessels, in the glands, and later in the connective tissue about both, forming abscesses. If the infection is less virulent or becomes weakened through treatment, the inflammation diminishes in severity, the exudate liquefies and is absorbed, and the affected vessels become normal in condition and function.

SYMPTOMS. — Certain constitutional symptoms appear which are dependent upon the severity and extent of the infection. The patient is not infrequently seized with rigors, followed by a febrile action and attended, not infrequently, by vomiting or diarrhœa. These symptoms may precede the local signs of the disease by twelve or fourteen hours, but most frequently accompany them. Examination of the parts, if superficial, will reveal a number of fine, red streaks, at first scattered, but gradually approaching one another so as to form a distinct band, about an inch in breadth, running from the affected part along the inside of the limb to the neighboring lymphatic glands, which have become enlarged and tender. The band itself feels somewhat doughy and thickened. More or less œdema of the limb is present, from the involvement of the deeper layers of vessels and their obstruction by the inflammation. Erysipelatous patches not infrequently appear along the course of the inflamed absorbents, and coalesce until they are of

considerable size, and constitute a distinct variety of erysipelas. If the deeper-seated lymphatics are first implicated, the glandular signs are first observed; if the inflammation continues to be confined principally to the deep vessels, it gives rise to a great and brawny swelling of the limb, with much, if any, superficial redness. The constitutional symptoms, at first of an active form, may gradually subside into the asthenic type.

DIAGNOSIS. — The diagnosis of superficial lymphangitis is usually easy. The tender red streaks indicate the tubular variety. The diffuse redness of the reticular form, with its superficial œdema, tenderness, and constitutional symptoms, differentiate it from erythema or dermatitis. From phlebitis it is distinguished by its superficial redness, the inflammation of contiguous glands, and the absence of the knotted corded state which belongs to an inflamed vein; the pain and fever are usually less in phlebitis. Inflammation of the deep lymphatics is not easily differentiated from cellulitis; if glands are early involved, if lymphatic œdema is present, if patches of reticular lymphangitis appear at points of anastomosis with deeper trunks, inflammation of the deep lymphatics may be assumed (Keen and White).

ETIOLOGY. — The etiology of the reticular variety has already been referred to. Tubular lymphangitis is always caused by the entrance into the affected duct of bacteria and bacterial products of more than usual virulence. The absorption of septic matter from infected wounds always follows, but does not generally cause an extensive inflammation of the lymph-channels; impaired constitution or general debility will predispose to it. Frequent irritation of the infected wound or retention of septic secretions in it are frequently exciting causes. Trivial

wounds may be infected with virulent septic material (snake-bites, dissection wounds); bathing the hands in putrid fluid for some time, without any breach of surface, has been followed by lymphangitis.

PROGNOSIS.—The disease usually terminates in resolution at the end of a week or ten days; exceptionally it may terminate in erysipelas. In some cases limited suppuration may take place or a chain of abscesses form along the course of the lymphatic vessels and glands. In other cases, after the disappearance of the inflammatory symptoms, a state of chronic and rather solid œdema (lymphœdema) is left, giving rise to a species of false hypertrophy (see **ELEPHANTIASIS**). More rarely death results from erysipelas, pyæmia, or from secondary abscesses, especially in patients with impaired constitution, in whom the disease has been extensive and has become associated with low cellulitis.

TREATMENT.—Lymphangitis being a septic disease, the treatment should be conducted on antiseptic lines. The original wound, through which the septic virus has gained entrance into the lymphatic circulation, should be thoroughly cleansed and disinfected. The affected limb should be elevated and kept quiet. Free incision will relieve any tension, and is advised even before the appearance of suppuration. All foci of suppuration should be evacuated by incision, disinfected, and drained. Compresses wet with an aqueous solution of bichloride of mercury (1 to 2000) should be laid upon the affected parts, the compresses being remoistened as they begin to dry, and re-applied until the inflammation has entirely disappeared. The constitutional symptoms usually demand more or less attention, especially in the direction of

support and free elimination. Opiates may be needed to relieve pain, but their use should be avoided if possible, as they diminish the secretions. Quinine and strychnine are valuable in tonic doses. The mineral acids and bitters are useful, as digestion is usually impaired. Nourishing food should be freely administered, and stimulants in the more severe cases. Bandaging and massage will best overcome any œdema which may be left after the acute symptoms have subsided.

Lymphadenitis and Inflammation of the Glands. See **ADENITIS**.

Lymphangiectasis and Lymphangioma.

—The lymphatic vessels, like the veins, are subject to varicosities and dilatations, which are called lymphangiectasis, or varix of the lymphatics; when these dilatations are large or when several of these dilatations unite to form a distinct tumor, it is known as lymphangioma. Lymphangiectasis has been observed in the superficial and deep lymphatic networks and in the lymphatic trunks. The inner side of the thigh is the favorite location for this disorder, but it has also been seen in the anterior abdominal walls, about the ankle- and elbow- joints, and on the prepuce. In the superficial lymphatics this condition appears first as small elevations, giving the skin an appearance like the rind of an orange; subsequently it appears as small vesicles covered with a thin layer of epidermis. The larger lymphatic trunks are, at the same time, frequently affected in like manner. The vessel may either be dilated cylindrically into round, beaded enlargements, often semitransparent, and but slightly compressible, or ampullæ may be formed on them, giving rise to more or less soft swellings, fluctuating under the finger (Erichsen). There is usually some œdema (lymphœdema) either from obstruction of the

lymphatics or from the impeded flow of the lymph; the affected parts may become swollen by a hard, compact, brawny œdema which is not reducible by position or pressure (lymphœdema). This condition leads up to elephantiasis (see ELEPHANTIASIS).

In a majority of recorded cases a discharge of lymph (*lymphorrhagia*) has been observed, caused by a rupture of the vesicles. This flow of lymph is of variable amount and duration, and is apt to be intermittent in character. There is another form of lymph-discharge which occurs normally from all wounds as a result of rupture or incision of the lymph-radicles or smaller trunks; this is known as *lymphorrhœa*. An excessive discharge of lymph in either manner provokes symptoms of general debility like those induced by hæmorrhage. Rupture of a dilated lymphatic along the urinary tract and the consequent lymphorrhagia produce *chyluria*. If the tunica vaginalis testis be the seat of a lymphorrhagia, *chylocele* results. Varicose swelling of the lymphatics in the inguinal regions may simulate hernia. Dilatations of the blood-vessels may co-exist with those of the lymphatics, producing a mixed tumor. When such mixed growths occur in the tongue, they produce an enlargement of the organ known as "*macroglossia*"; when occurring in the lips, this enlargement is known as "*macrocheilia*."

A large proportion of cases of lymphangiectasis are congenital in their origin. These cases may be due to vicious development of unknown character or to obstructions to the lymph-stream of a mechanical or inflammatory nature during intra-uterine life. Inflammation and thrombosis are the usual causes of the acquired variety, resulting in a dilatation of the radicle and primary channels, with lymph-stasis and œdema of all the tissues

supplying the narrowed or occluded vessels. Cicatricial contraction, pressure by tumors, or occlusion of the lymph-channels by tuberculous or cancerous material may also be etiological factors in producing this condition. In a large class of cases occurring in tropical regions, the presence of the *Filaria sanguinis hominis* in certain lymphatic vessels has been shown to be the cause of lymph-thrombosis and inflammation. (See PARASITES.)

TREATMENT. — Circumscribed dilatations and isolated cystic enlargements may be removed by the knife. Massage, the elastic bandage, and support in an elevated position will give relief in the diffused dilatations and œdema due to persistent obstructive causes, in cases in which collateral lymphatic circulation may become sufficiently developed to relieve the stasis; when such collateral circulation is not developed and stasis is not relieved, these means will not suffice. If all other means fail, ligation of the main artery of supply to the limb would be justifiable. In a few recorded cases rapid improvement has followed; in others none. Amputation may be done, if the condition is confined to an extremity and causes serious annoyance. Similar tumors involving the genitals should be excised, care being taken to preserve the penis and testes by dissecting them out of the diseased mass. The use of the elastic bandage about the base of the growth will prevent hæmorrhage during the operation and facilitate the dissection (Keen and White).

Lymphadenoma. — Lymphadenoma, or simple lymphoma, is a tumor composed of tissue exactly resembling the cortical substance of a lymphatic gland—the so-called "*adenoid tissue of His*"; in fact, the change is purely an hyperplasia of normal gland-elements. (See TUMORS.)

Malignant Lymphoma (Hodgkin's Disease; Pseudoleukæmia). (See PSEUDO-LEUKÆMIA.)

Sarcoma of Lymphatic Glands, or Lymphosarcoma.—This is a condition in which sarcoma attacks a lymphatic gland. In the early stages it differs little from other glandular hypertrophies, but later it manifests its malignant character by

involving adjacent tissues and by the appearance of secondary deposits in the various internal organs. In its early development it may be excised, together with the surrounding tissue. If return occurs and the tumor be on one of the limbs, immediate amputation is imperative.

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